Compressed Air Magazine

VOLUME 56 **November, 1951** NUMBER 11

EDITORIAL CONTENTS

ADVERTISING CONTENTS

A monthly publication devoted to the many fields of endeavor in which compressed air serves useful purposes. Founded in 1896.

CCA Member Controlled Circulation Audit

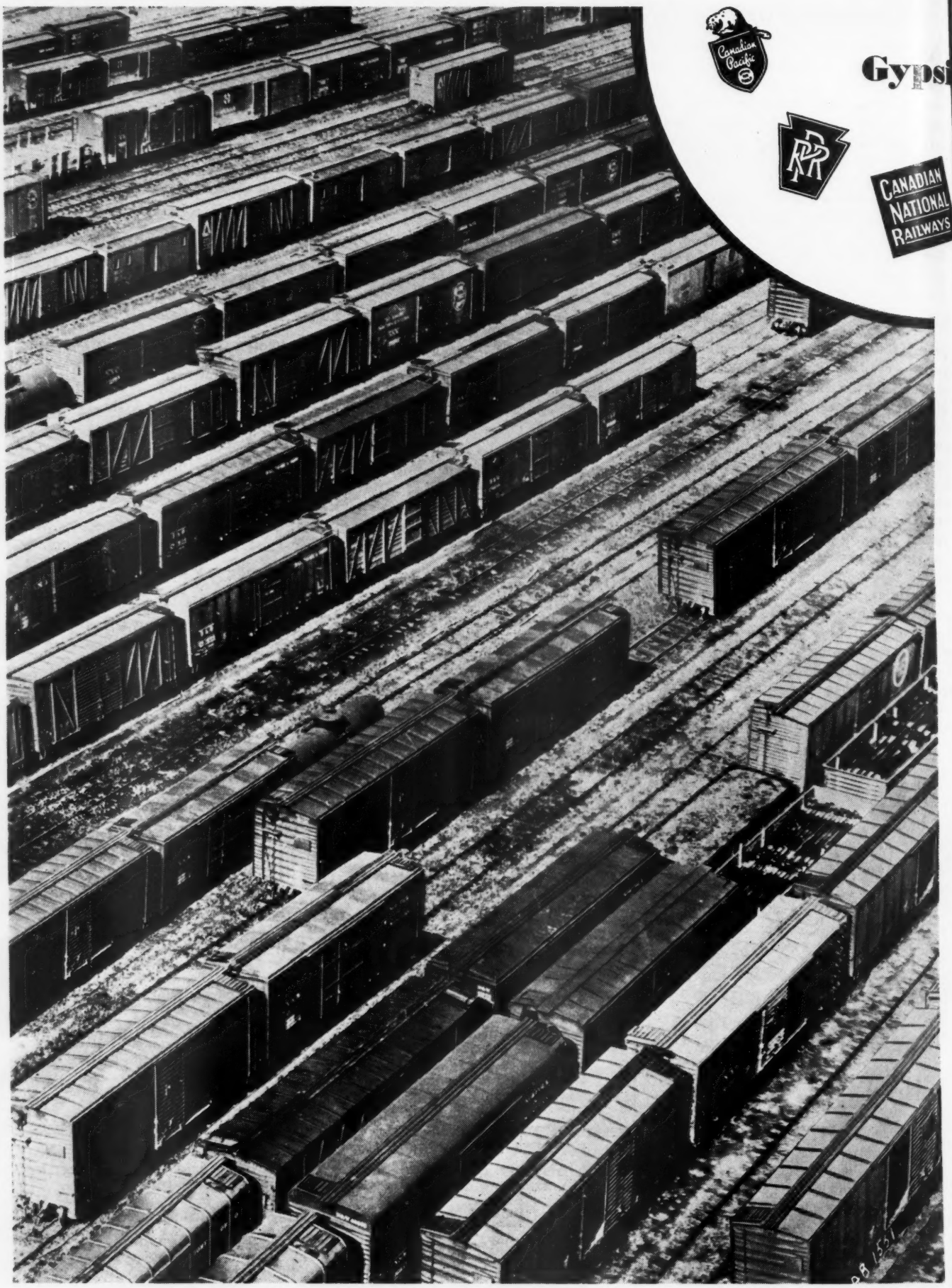
Published by Compressed Air Magazine Co., G. W. MORRISON, *President;* C. H. VIVIAN, *Vice-President;* J. W. YOUNG, *Secretary-Treasurer.*
Editorial, advertising, and publication offices, Phillipsburg, N. J
New York City Office, 11 Broadway. L. H. GEYER, *Representative.*
Annual subscription: U.S., $3.00; foreign, $3.50. Single copies, 35 cents.
COMPRESSED AIR MAGAZINE is on file in many libraries and is indexed in Industrial Arts Index and in Engineering Index.

ON THE COVER

NEAR Latta, S.C., a few miles from the Atlantic Ocean, stands one of the last symbols of a period when cotton farming was conducted entirely by hand. Built in 1798 by Henry Berry, grandfather of the present owner, the old press is still in good condition and was operated briefly in 1949.

It is located within a few feet of U.S. Highway No. 501 and tourists often stop to gape, take snapshots, and trample down the surrounding rows of young cotton plants. Cotton is still king on this 400-acre farm of J. Calhoun Hayes, but everything else is as modern as the press is ancient. The sand at the foot of the press shows the tracks of up-to-date farm machinery, and airplanes laden with insecticide fly overhead dusting the crops. Neon tubing outlines the press at night.

The press is about 30 feet high and the two opposed beams extending down from its top are each 40 feet long, made from a single timber, and covered with cypress shingles for protection against the weather. Cotton to be baled was first hand picked to remove seeds, then packed into the strong wooden box at the press bottom. The wooden screw, 16 inches in diameter and 14 feet long, was turned to compress the cotton to bale size, power being applied by men or mules to the ends of the beams. After being compressed, the bale was bound with wrought iron strips or ties, made by hand. A bale was turned out about every 1½ hours.



CARS AND MORE CARS

A section of the Potomac Yards, Alexandria, Va. Whether freight cars are on the move or standing still, their owners keep tabs on them through daily reports. Moreover, each one is listed by number in an official register that is revised quarterly. In a large yard such as this, cars will be found from all parts of the country.

the Rails

How the Owners of 1,750,000 Widely Wandering Freight Cars Keep Track of Them

Roy E. McFee

PHOTOS ASSOCIATION OF AMERICAN RAILROADS

YOU are driving over a country road when, suddenly, a railroad-crossing light flashes ahead and a warning gong begins to sound. As you stop your car at a safe distance from the grade crossing you become aware of the horn of a diesel locomotive drawing nearer. A mile-long manifest freight train comes rolling along over the main line of a great railroad system connecting two important American cities.

The first thing that catches your eye as the freight thunders past is the variety of the cars that make up the train. There are ordinary boxcars, with perhaps a flatcar among them loaded with heavy machinery. There are gondola and hopper cars heaped with coal; tank cars, refrigerator cars and automobile cars, besides stock cars carrying white-faced Hereford cattle. You may see, too, a special flatcar with a depressed center so high loads will pass safely under bridges of limited vertical clearance. It may have as many as eight axles—sixteen wheels—for transporting unusually heavy freight without breaking down and without excessive wheel-load concentrations on rails and bridges.

As more cars rock past you are reminded again that they are marked with the names or letters of many different railroads. Most of them probably bear the markings of the system on which they are traveling, but also to be seen are the familiar labels of other great trunk lines. You read Pennsylvania, Great Northern with its symbol of the mountain goat, Canadian National with its maple leaf, N.Y.C. for New York Central, C.& O. for Chesapeake & Ohio, and A.T.& S.F. with the cross for Atchison, Topeka & Santa Fe.

A score or more railroads may easily be represented, with no attempt whatever made to group together those of the same ownership. Indeed, you may even find a multiple load such as a huge steel pipe, perhaps 10 feet in diameter and 90 feet long, resting on the centers of two cars with an idler in between and that every one of the three belongs to a different system.

Some of the railways represented in the train will not be so well known and their names will not be at all familiar. It may include cars marked Barre & Chelsea, a Vermont line 48 miles long; Lancaster & Chester, a 29-mile-long stretch of tracks in Pennsylvania; or L.N.P. & W.R.R. for the Laramie, North Park & Western, a road with headquarters in Omaha, Neb., and having only nineteen freight cars.

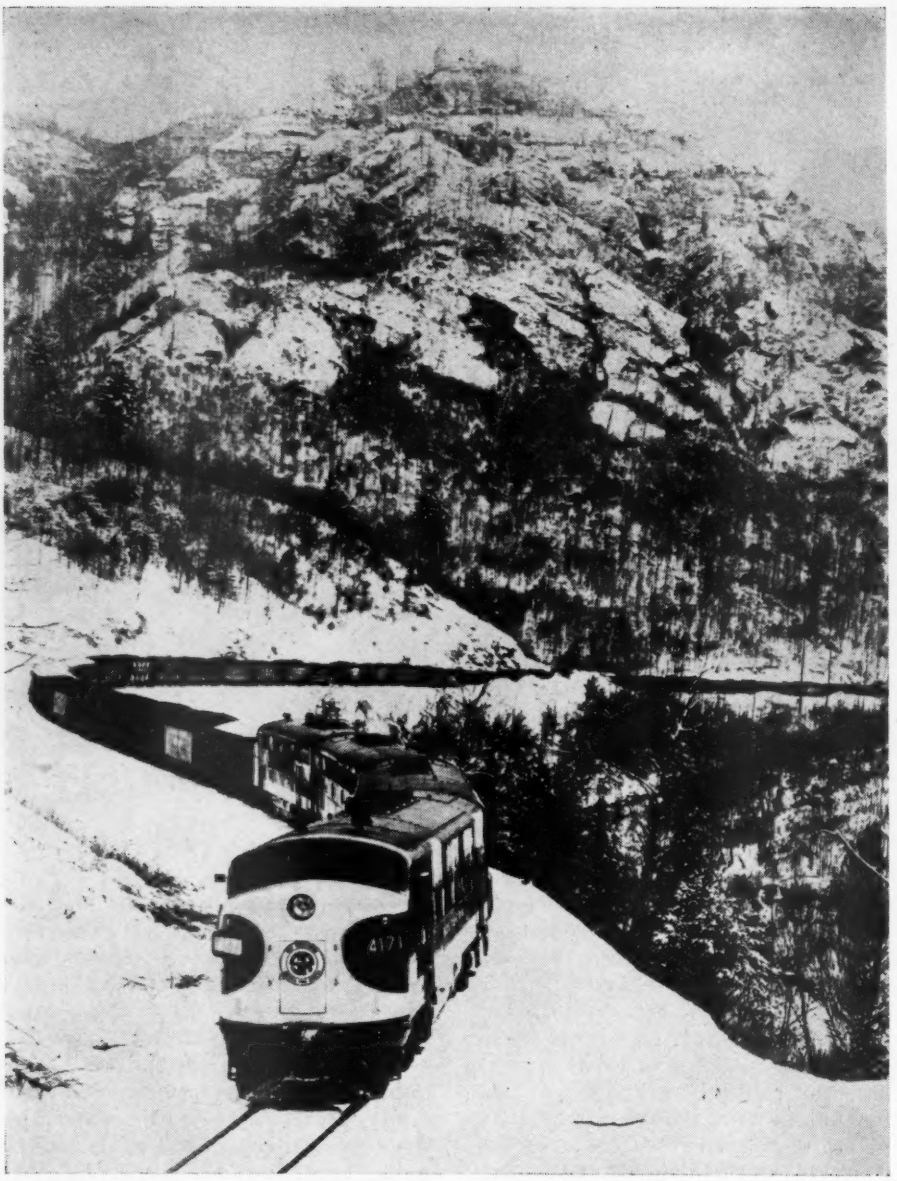
No wonder people often ask, "who owns a freight train anyway?" The question is answered, of course, by the markings on the cars which are traveling together because they have the same general destination or can take the same route part of the way. But there may also be cars in the train with lettering that indicates other than railroad ownership. Among these are tank, refrigerator and stock cars. Most of them bear the names of private companies, the largest of which are the General American Transportation Corporation, Union Tank Car Company, Pacific Fruit Express Company, Fruit Growers Express, Merchants Dispatch Transportation Corporation, American Refrigerator Transit Company, Union Refrigerator Transit Lines, North American Car Corporation, Western Fruit Express Company, and the Sinclair Refining Company. Therefore, the freight that rumbles past you at the grade crossing is owned by many railways and private concerns.

The many names to be read on the sides of a single freight train give us only a brief introduction to the transportation system of the United States. Usually, when we think of railroads, we remember only the more prominent ones such as the trunk lines (Chicago to the Atlantic seaboard), the transcontinental lines (meaning those running from Chicago to the Pacific Coast), a few other large ones and one or two in our home locality—possibly 30 in all. It is, therefore, a little astonishing to learn from the Official Railway Equipment Register that there are 280 railroads in the United States whose freight cars go beyond their own lines. Many of them are only a few miles long and own perhaps less than 100 cars each. In addition, the register lists several hundred private companies having freight cars moving over rails in the United States, Canada and Mexico.

Privately owned freight cars came into existence in response to a real need. Years back, shippers of commodities such as petroleum, chemicals, fruits, meats, and livestock recognized that special equipment would be required to carry them. The railways were slow in providing adequate facilities, so the shippers built their own tank, refrigerator and stock cars and the railroads actually rented them to haul the owners' freight.

Later, private car companies entered the picture by leasing special freights both to shippers and to railways. Some of them construct their own cars and also maintain repair shops for them at convenient points throughout the country. These concerns keep track of their cars, which travel freely over the various systems, and often are able to get them moving more promptly than even the average railroad can expedite its own cars.

Now, as the very latest development in special cars, there is the privately owned boxcar that can be readily adapted to carry every kind of freight usually transported in cars of that type. This is made possible by adjustable shelving, cross members and bracing clamped in place to form partitions and multiple decks to take merchandise of any size



SNAKING THROUGH THE MOUNTAINS

Trainload of coal en route from mine to market running through June's Mill Gorge, in southwestern Virginia, on the Southern Railway.

and quantity. It is claimed that these structural features increase the capacity of a boxcar by as much as one-third, that they insure safe transit, and that they eliminate dunnage, reasons why shippers tend to favor the roads that use these facilities.

Referred to as damage-free loader cars, they are built by the General American Transportation Corporation and are leased to railroads through a subsidiary, the General American-Evans Company. The latter assumes responsibility for maintenance and repairs and keeps tabs on the cars. Several hundred, painted hunter green with a yellow diagonal stripe, are already in service. Altogether, there are about 1,750,000 freight cars of all ownerships moving over our railroads. Of these, considerably more than 300,000, including approximately 100,000 tank cars, are privately owned. Every one of them has real individuality. It is on record more than a person with his social-security number.

The cars in the freight train that you are watching at the grade crossing are marked with the owner companies' letters or names, as well as with individual numbers often running into six digits. Each railroad or private concern has a complete list of its cars by number. Not only that, but should someone duplicate the name and serial number of any particular car in a train, the owner can find a record of it in the 800-page Official Railroad Equipment Register, a quarterly publication.

This book is used by all railways, private car companies and by shippers generally. It contains a complete description of every car—its type, length, width, height and capacity in pounds or gallons, together with any special features that indicate whether it is a depressed flatcar, a well car, etc. The total number of cars an owner has in each series is also given. It is clear then that all these freights, old and new, owned by this or that railroad or private concern, are hauled around together in trains and must be alike in certain respects. For instance, their couplers and air brakes must be interchangeable. It is obvious, too, that their wheels must be spaced for the same track gauge.

Standard gauge is 4 feet 8½ inches clear distance between the heads of the two rails. It was first used in England, and by 1887 most of the roads in the United States had adopted it. Today, that gauge is in effect on practically every mile of railway in this country. Obviously, it will never be changed, for that would mean changing all our rolling stock—freight and passenger cars and locomotives. If widened, it would necessitate putting in longer ties with broader ballast sections on nearly 400,000 miles of trackage in the United States alone. It would involve spreading the rails by pulling and redriving five billion spikes and increasing the distance between adjacent tracks, renewing switches, and generally widening bridges or rebuilding them altogether. And all this would have to be accomplished wellnigh over night!

Now we come to the compelling reason for the endless travel of a freight car over the railroads of the United States, Canada and Mexico without much regard to its home road. Why does a car leave its own rails? There is indeed a fundamental reason therefor. The arrangement obviates unloading one car and loading the freight on to another at a junction point between railroads, saves labor cost and time, and prevents damaging goods in rehandling.

Nor is that all. The next road to handle the freight might not have a suitable car ready at the junction. This consideration becomes of increasing importance in the case of special cars provided with devices such as the auto loader which makes it possible to put more automobiles in a car and to handle them with safety and efficiency. On the other hand, a railroad might have to let valuable cars stand empty and idle waiting for loads. Altogether the expense, delay, and inefficiency would be intolerable.

Hence the free interchange of cars, with freight moving in the same carrier from shipper to destination. One sees cars from the Pacific Coast rolling along the Atlantic seaboard, and cars from the Deep South at the Great Lakes. Any large railway yard will, in a short time, handle freights from every important line in this country and Canada.

Of course, railroads observe certain rules governing the exchange of freight cars. These regulations, printed in fine type in the back of the Official Railway Equipment Register, cover several large pages. But condensed to simple terms

FREIGHT RENDEZVOUS

Ashtabula Harbor Yard, the largest of three New York Central collection centers in the Ohio city, is devoted almost entirely to the handling of coal and iron ore. The empty hopper cars in the foreground have dumped their cargoes of coal into the holds of Great Lakes steamers. The loaded cars are on their way to the docks to do likewise. Iron ore brought in by the same boats from the head of the lakes is carried by the railroad to steel mills in Ohio, Pennsylvania and other eastern states. On such service the railroad uses its own cars almost exclusively.

they mean that a railroad shall not send its cars off its own rails when it is practicable to use cars belonging to other lines, and that, when foreign cars are loaded, they shall, if at all feasible, be returned to their home roads or at least moved in that general direction.

But how does a railroad keep track of its freight cars on other rails? And how does it know that they are being maintained in good running order? That is the problem of the Car Accounting Department of every railway. It is usually comparatively large and headed by the car accountant who is generally directly responsible to the superintendent of transportation. His personnel numbers anywhere from 50 to several hundred and is made up of women, with an occasional man. Individually and collectively, they do the intricate work of car accounting. They sit at the record panel sorting an avalanche of reports, or at their desks compiling other reports, computing charges, doing endless checking and searching and entering permanent records into books so huge that they seem to cover the desk tops. The really interesting story behind all this paper work will be told presently.

But it is only fair to say first that these women, many of whom have had years of experience, are highly efficient, dependable and altogether indispensable. However, they would probably be surprised if told so. One of them once remarked with characteristic modesty, "Most of us are doing specialized work in car accounting but we seem to have a good grasp of the entire set-up. We understand it, but find it hard to explain."

Actually, the department keeps track of all cars of whatever ownership on its own road, as well as of all its cars on other lines. This is done by means of daily reports which come in from its agents and from other systems and form the basis for all the paper work in the car accountant's office. The railroad's agents at the various junctions with other lines write daily interchange reports which list by ownership and serial number all cars delivered to other railroads and received on that day. Likewise, daily wheel reports concerning movements of all freight cars of every ownership over the road's own trackage are made out by their conductors. At the same time, agents send in daily lists of cars in yards and on sidings. These too give ownership and serial numbers.

These daily records usually reach the car accountant by way of the system's own private mail service in envelopes marked R.R.B., meaning Railroad Business. However, in some cases U.S. Mail is used to save time. In either event, the reports arrive one or two days late. The general adoption of teletype for this purpose will doubtlessly expedite matters greatly; but, except for a few lines that are taking the lead, that is still in the future.

In the accounting department the reports are cut into strips each of which represents an individual car, are sorted into bundles according to ownership, and the information is entered into the record books. Then, on the basis of the interchange reports, a daily junction report is sent to every railroad and private company which own the cars handled that day by the road under consideration. Similar daily junction reports come into the car-accountant's department from all railroads that transfer cars belonging to its line to other lines. These also arrive several days late.

Because of this interchange of data, every railway always knows the approximate location of each car on its own rails and the general whereabouts of its

CLASSIFICATION YARDS

Convenient to all large centers they serve, each railroad has a yard where cars of freight are classified and assembled into trains bound for all parts of the country. From one or more main feeder tracks, cars go over a "hump" to enter any one of a multitude of branches to which they may be directed. Shown at the right is Hump Yardmaster D. J. Webster of the Santa Fe lines in his tower at Argentine, Kans. Fanning out in the background are 57 tracks. Pictured below is the classification yard of the Belt Railway of Chicago, which is an interconnecting link for all the railroads that enter the city.

cars on other lines. Of course, if it really wants to know the exact location of any one of its cars on another road, the latter can be asked to trace it. What a story of adventure the permanent records of the car-accounting department sometimes tell! A typical boxcar once was found to have rolled over 39 different railroads in one year and to have been at least twice on 24 of those roads.

On the other hand, errors do have a way of creeping into the reports and may cause months of searching and uncertainty. Sometimes one digit in the serial number of a car is wrong. Another common mistake is to interchange the position of two figures. Such seemingly slight errors can make a tremendous difference, and often much time elapses before they are rectified. Sometimes a year passes by before the car is discovered . . . on paper, of course.

There was the case of a boxcar that was lost on its own system, leaving no trace. Months went by, and finally one man in the department was asked to spend all available time running it down. He checked and hunted until its serial number was indelibly fixed in his mind. Two years passed, and still no clue as to the whereabouts of the missing freight. Then one evening at home, when he was reading the latest issue of his railroad's magazine, his glance fell upon a picture of a boxcar with the trucks off and resting on the ground along the single track of a branch line. Deep woods were in the background, but in front were neat flower beds. There were curtains at improvised windows, and a contented-looking couple was standing in the doorway. The descriptive matter explained that a section foreman and his wife were making this erstwhile boxcar their home. And literally shouting at him was the serial number on the side of the car for which he had searched these many moons. At the car-accounting department it was written off the books the next day.

There is big money involved in freight-car interchange between railways. According to the present agreement, the rental for any railroad-owned freight car is $1.75 a day when it is on a road other than its own. This holds true no matter what the age or value of the car, and whether it is standing empty or moving with a load to a distant destination. This means that a railroad, besides paying that amount daily for every car on its rails owned by another line, also receives $1.75 for every one of its freights that is not at home on that day. This is called the per diem rate in all railway offices. An exception to the per diem rule applies to refrigerator and tank cars which some roads have placed on a mileage basis. Privately owned cars also are on a mileage basis, which requires a separate set of figures.

The car-rental agreement obligates the accountant to compile monthly reports and to send them to all railroads whose freights have been on the tracks of his company's system during the month. These statements show the serial number of each car and the number of days it has been on the line, as well as the total car days and corresponding per diem amount his road owes the others. Like reports come to him, and the difference between the two sums is paid the creditor road in each case. While the per diem total for a great railway system for one year amounts to many millions of dollars, the aggregate on the other side of the ledgers may be about the same, striking a near balance. On the other hand, the difference may come to as much as a million dollars or more.

In reporting car interchanges at junctions, the calendar day starts at midnight. A car received from and returned

COUNTING NOSES

Each railroad has a car-accounting department to keep track of all the cars currently on its line and also of its own rolling stock on other lines. Depending upon the size of the road, this requires anywhere from a few up to several hundred persons. Almost all are women, though a man, generally responsible to the superintendent of transportation, heads the department. A few members of the Illinois Central's staff are shown at the bottom. The young man pictured at the left is keeping tabs on the various cars of freight that pass through one of the yards of the Norfolk & Western Railway.

to an owner railroad on the same calendar day does not involve per diem payment. Moreover, any string, of whatever ownership, delivered by one line to another just before midnight means a profit to the road making the delivery: it means $1.75 gained for every one of its own cars transferred to another line and $1.75 in rental avoided for each foreign car it gets rid of. Operating men at junctions are therefore continually reminded that minutes count, and the stars have looked down on some hurried switching movements made just before the steeple clock struck twelve.

There is one other important consideration in this free interchange of freight cars, and that is the matter of repairs. Sometimes cars break down far from home, or they need minor attention before again reaching their own rails. Generally, a crippled foreign car is put upon the repair tracks of the road temporarily in possession of it and is restored to working condition. What line finally bears the expense is determined by a code of rules already agreed upon by most railroads.

If the damage is attributable to ordinary wear, which normally involves couplers, flanges and treads of wheels and impaired brake parts, the owner of the car usually foots the bill. Payment is made by the responsible road after its car accountant has determined that the car was actually on the other line at the time. But if the damage was incurred in an accident, derailment, or through unreasonable usage, the cost of repairs must be borne by the line on which the car was moving at the time. In either case, per diem rate is suspended while the car is out of service.

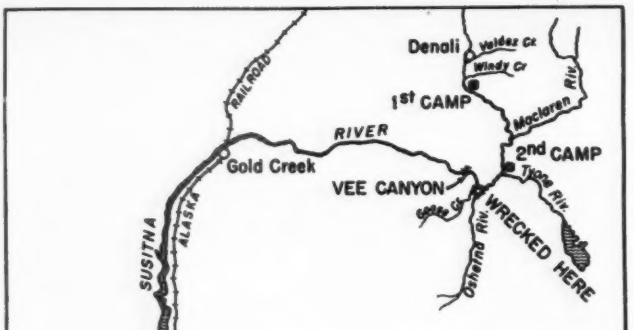
Thus the railroads of the United States, Canada and Mexico, together with those of private companies, coöperate behind the scenes to provide what appears to be a unified system. A person in Massachusetts receiving a carload of Douglas fir from Oregon is not aware of the fact that it has been handled by more than one line. Entirely hidden are the car interchanges, the reports and the charges between railways.

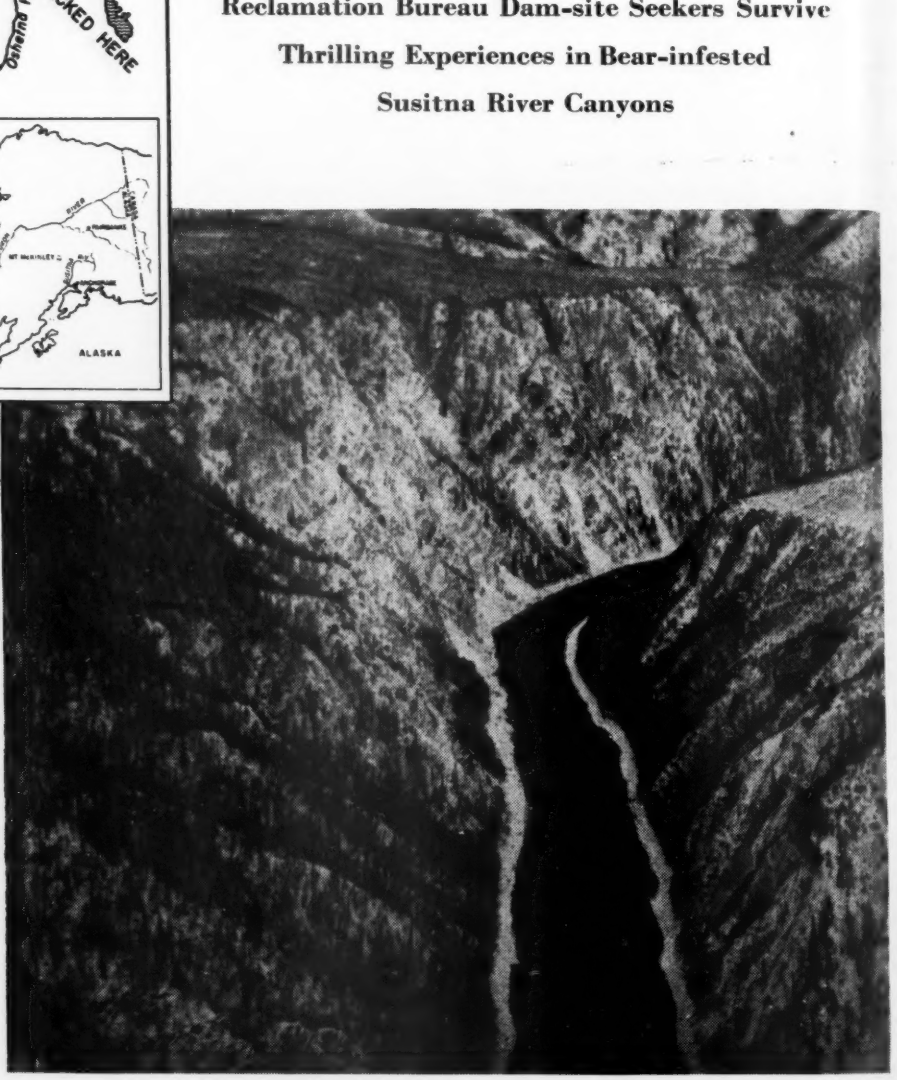
This is all the more remarkable considering what a maze these combined transportation arteries represent. Great railroads and small ones lie side by side or end to end. They cross one another in thousands of places and have junctions well-nigh everywhere. Wall Street may regard them as natural competitors, but 1,500,000 railroad employees make them mesh together through the magic click of the telegraph key.

Unrestricted interchange of freight cars, per diem and mileage charges, and monthly adjustments have kept pace with the growing needs of the years. This perfect coördination makes extensive railroad consolidation entirely unnecessary from an operating standpoint, for already the railways of three neighboring countries in North America function for all traffic purposes like a single system.

Drama in Alaskan Wilds

Reclamation Bureau Dam-site Seekers Survive Thrilling Experiences in Bear-infested Susitna River Canyons





LOCATION MAP AND VEE CANYON

The party was flown from Anchorage to a point near Denali, from where the boat trip down the river began. It came to grief on the fourth day when swells of unusual size swamped the two aluminum craft. The picture shows Vee Canyon, one of the most promising dam sites and the goal of a second trip that resulted in a smashed helicopter. The photograph was taken from the ill-fated plane as it came in for a landing.

SECRETARY of the Interior Oscar L. Chapman has written the conclusion to a story of high adventure in the Alaskan wilderness, with awards of medals and promotions for six Bureau of Reclamation fieldmen and a guide for indomitability, ingenuity, and courage in the face of difficulties and danger. The men volunteered last summer to penetrate one of the wildest and least-known parts of the territory to make surveys and studies of possible dam sites on the Susitna River. Though twice stranded without food or supplies by the wreckage of boats and helicopters in the rugged terrain, they persisted until their task was accomplished.

The men honored are: Daryl L. Roberts, Juneau, 42-year-old engineer and chief of the party; Ade E. Jaskar, 38, geologist, of Juneau; Terrence L. Robbins, 33 years old, instrumentman, of Palmer; Harry Johnson, 25, a rodman, of Juneau; Edwin Stewart, 21, surveyor, of Palmer; and William Weber, 30, mechanical engineer, of Juneau. The guide was Frank Swanda, 55, of Anchorage, Territory of Alaska.

Only a few prospectors and trappers had ever gone into the Susitna area before, and, so far as is known, not even a native has run the river through its steep, wild canyons by boat. The region is infested with wild animals, including grizzlies and Alaska brown bears. However, the country holds great promise for the future of Alaska, for there the rapid Susitna flows through a series of deep, narrow gorges. Dams built in these cayons would generate great quantities of hydroelectric power—at present one of the territory's most crippling shortages.

With low-cost electricity, the coal fields of Alaska can be opened, its timber can be milled and processed, pulp and paper can be produced, the mineral resources of the region can be refined and developed, and comforts and conveniences can be brought in to make brighter the lives of those who live in this American outpost under the Arctic Circle. Alaska is one-fifth the size of the continental United States. It is a land of undeveloped, unexplored potentialities and of great strategic significance. But its total population is only 95,000 whites, concentrated largely in a few seaboard settlements, and about 30,000 Indians, Eskimos and Aleuts.

Before dams can even be proposed, extensive surveys and studies of sites are needed. To gather this knowledge, four Reclamation engineers volunteered to penetrate to the gorges of the Susitna, to study the geologic structure of the rocks, to seek out resources of gravel and other construction materials on the spot, to make accurate surveys of possible dam and reservoir sites, and, if feasible, even some contour profiles.

The first thought was to explore the canyons in winter, making the trip by dog sled. With this in mind, Roberts and Jaskar took the Army indoctrination course on survival in the Arctic conducted at Nome, Alaska. This plan

had to be abandoned when careful advance reconnaissance by plane revealed the river had considerable open water during that season of the year and was unsafe for travel. The group then proposed to navigate 120 miles of unknown water in midsummer, using two boats, with the run ending at Devil's Canyon where a base camp was to be set up and supplied by air. From there the remainder of the survey was to be carried out on foot or by helicopter.

The Devil's Canyon camp was ready by early July, when three men—Percy Crosby, John Monagle and Ralph Hasper—were flown in to await the arrival of the boat party. Hasper is a helicopter mechanic. On July 9, Roberts, Jaskar, Robbins, Johnson and Swanda were transported by float plane to a spot on the banks of the Susitna opposite the mouth of Valdez Creek where, long ago, a gold camp named Denali had existed. The following day two Douglas aluminum Air Skiffs, one 14 feet long with a 56-inch beam and the other 15 feet long but narrower, were brought in by helicopter. Aluminum boats were chosen because they were light and could be flown in. Each was powered by a 10-hp Johnson outboard motor. The men were outfitted with .375 magnum bear guns, full surveying equipment and needed supplies which, when the last gasoline had been picked up, brought the total weight of their equipment to about 2200 pounds.

The party started downstream on July 10. The first day the men made only 10 miles. Though they spent most of their time pushing, poling, and dragging their boats over sand bars, they did survey one possible dam site between Butte and Windy creeks. That evening, as they established camp near Butte Creek, a float plane dropped them additional needed gasoline. The next day they explored another site and covered 27 miles, camping at night about 3 miles below the mouth of the MacLaren. They resumed their trip on July 13, with fine prospects for a good run. The sand bars seemed to have been left behind. At the mouth of the Tyone River they picked up their last cache of gasoline, which had been dropped in advance by float plane.

Then the men began to encounter boulders in the stream. The water broke into an almost constant series of rapids, not turbulent enough to be dangerous but swift enough to drench them with spray. Twice they beached their craft for bailing. Towards noon they experienced a hazard for which their aerial reconnaissances had not prepared them. About a mile above the mouth of the Oshetna, the river suddenly surged in two or three extraordinary swells extending almost from shore to shore. The boat with Roberts and Johnson in it was about ¼ mile ahead of the second craft and out of sight around a bend when it hit these swells. The first wave dumped 4 inches of water into the light vessel, the second one almost filled it, and then, buffeted by further swells, the load shifted and the boat capsized. A few moments later the second craft hit the same spot and suffered the same fate.

Young Johnson managed to clamber aboard the keel of the leading vessel, but Roberts was left clinging to the bow, in danger of being dashed or crushed against submerged rocks. Johnson's efforts to ride the keel resulted only in the boat rolling and throwing them both into the icy water. Roberts soon became so exhausted that he grabbed the tie rope and held on, while Johnson clung to the end of the craft. Jaskar and Swanda grasped cleats on the bottom of their boat and were borne along through the boiling water. Robbins, flung completely clear, went whirling off clinging to two packsacks containing sleeping bags. Fortunately, all the men were wearing kapok life jackets.

Choking, gasping, and unable to control their course at all, the men were swept downstream for about half an hour. They passed the mouth of the Oshetna, where an inpouring flood added to their speed. Then, as the current bore them near the north shore, Roberts and Johnson tried to beach their vessel

WRECK AND SURPRISE

Jack Zimmerman, pilot, is pictured at the left packing food salvaged from the wreck of the helicopter in which he took three Bureau of Reclamation men back to the Susitna to complete their investigations of Vee Canyon. From the wreck, Zimmerman and Jaskar set out downstream on foot and came upon the huts shown at the top. In the one on stilts there was a cache of food.

SUSITNA DAM SITE

At left, rapids at Devil's Canyon, looking upstream. This is one of several possible sites for hydroelectric power plants. Nearby was the base camp (above) from which the party intended to conduct its final investigations. However, it never reached that goal.

but failed because of exhaustion, and abandoned it. Struggling from the water, they saw Jaskar and Swanda plunging along behind them. Roberts shouted: "Let the boat go—save yourselves!" Just at that moment the craft rolled completely over in a swell, burying the two under the surging water. As the men and boat emerged, a quirk of the current brought them into a shallow spot. Quickly seizing their advantage, they managed to get themselves and the boat ashore.

Robbins was nowhere to be seen. When last sighted, he had lost one of his packsacks and was clinging to the remaining one. The four men, despite their cold and drenched clothing, hurried downstream along the rocky beach. After half a mile of anxious searching, they saw him being carried ashore by the current and reached him in time to pull him out of the water. They were then 3 or 4 miles downstream from the point where they had overturned; the time was about 2 p.m. Miraculously all escaped injury, except for a bad bruise on Johnson's elbow and a slight cut on Roberts's hand, which Jaskar bandaged with a piece of his underwear. However, they were soaked, and faced the subarctic wilderness with nothing except what was in their pockets. Robbins had lost one of his boots. Although the sun would set at midnight and rise at 2 a.m., the short Alaskan night was bitter.

The men then began to look around for what they could salvage of their supplies along the sloping beach. The first thing they picked up was a package of washing powder. It is still there. Their guns of course were lost—a distressing situation in bear country. But they found about 4 pounds of water-soaked flour, a pound of baking powder, 4 pounds of butter, a small can of salted peanuts, one can of powdered milk, a can of dehydrated eggs, eight onions, and, most important of all, several packs of waterproofed matches. They also recovered two survey rods, a 14x16-foot tarpaulin, four sleeping bags, four air mattresses, Johnson's fishing rod and a short length of nylon line but no hooks or other tackle, and Jaskar's musette bag containing books, maps and small instruments. This latter find was to prove important.

With this small stock they made camp on a gravelly, gently sloping beach covered with driftwood. A few yards behind them the banks of the canyon, covered with tundra grass and willows, rose 150 feet or more. Before them was the ever-roaring river. They rationed their scanty food supply, allowing for several days beyond the date when, according to arrangements, a search for them was to begin if they failed to keep a rendezvous. For a distress signal they set up the two transit poles in the form of an X and put an orange life jacket at the end of each rod. They fashioned cooking utensils from gas and oil cans, whittled ladles from crate wood, and made forks from willow branches. And they organized regular patrols to keep combing the beach for salvage.

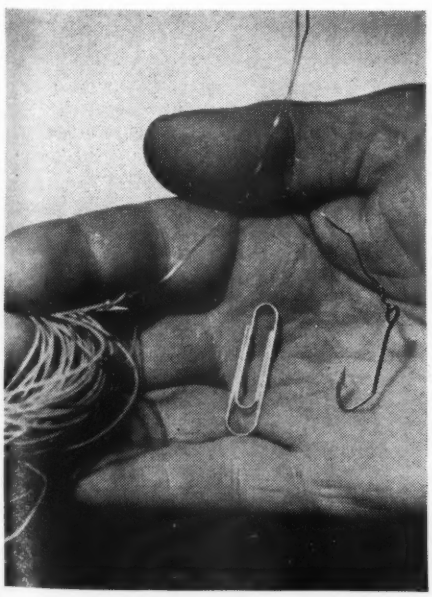
During the next six days the men managed to collect two mosquito nets, two pairs of oars, a packsack, a jacket, two caps, two small telescopes, 30 gallons of gasoline, 8 quarts of oil, a transit box (the transit had fallen out in deep water), parts of three water-soaked loaves of bread and seven packages of dehydrated noodle soup, now thoroughly rehydrated from floating in the river. Laying the tarpaulin on the beach, they put the mattresses on it crosswise, covered them with the sleeping bags, and lapped the tarpaulin back on top, thus making a single bed for all five. That night, exhausted from the day's ordeal, they slept well, despite hunger and anxiety.

The next day Roberts and Jaskar, prowling upstream, found their way blocked by the rushing Oshetna. On

the opposite bank were the ruins of a cabin, presumably built there long ago by a trapper. The door had been completely smashed in by bears, precluding the chance of finding supplies. So they made no attempt to cross the heavy rapids. When they returned to camp with news of their discovery, the evidence that they were in bear country made each man realize the more the perils of their predicament. The Alaskan brown bear is the world's largest carnivore. Attacked by such a creature, a man is in trouble even if he has a .30 caliber rifle. The luckless survey party had only pocketknives.

As the long afternoon wore on, Jaskar opened his musette bag and began spreading his maps and notebooks out to dry. A number of paper clips fell to the ground. Johnson, sitting nearby and idly watching, picked one up. After a moment he sought out a flat rock he could use as an anvil and another stone for a hammer. The young rodman, born and raised in the territory, was using his Alaskan ingenuity to make fishhooks. First he cut three paper clips in half and flattened one end of each. The other end he looped around to make the eye. Then he scraped the flattened portions to a point, using rough stones as files. Finally, he drove a knife blade half way through the flattened metal and, carefully turning the blade upward, created the barb.

The others had watched Johnson with growing enthusiasm. Before he was finished they had cut willow poles. Swanda found a piece of blasting wire in his pockets which could serve as a leader; Jaskar's pockets yielded several shipping tags from the wires of which more leaders were fashioned. Then Johnson, Robbins, and Swanda set forth down the beach, Swanda swatting horseflies on the way to use for bait. A mile downstream they came to a little tributary creek, and there they tried out their fishing tackle. Within a few hours they had landed thirteen large grayling weighing from 1½ to 3 pounds. After the bait was used up they tried fish eyes with equal success. That evening the party had a chowder of fish, onions, and powdered eggs. It lacked salt, but it filled their stomachs. Even more cheering was the knowledge that they now had a means of replenishing their rations. As a matter of fact, during their vigil the men caught 74 fish with their paper-clip fishhooks. They banked their fire and crawled under the tarpaulin in a more cheerful frame of mind that night—bears or no bears.



IMPROVISED FISHING TACKLE
A hook, fashioned by Harry Johnson, native Alaskan, from half a paper clip with the aid of only stones and a pocketknife, made it possible for the group to eat. Using blasting wire and shipping-tag wire for leaders and willow branches for rods, they caught a total of 74 grayling in a tributary to the Susitna.

By the third day it had become apparent that little more was to be salvaged from the beach. Rather than wait in idleness, Roberts and Jaskar decided to make a systematic exploration of the river downstream, carrying out as much of their original task as they could with the available pocket instruments. Taking a share of the supplies, they covered 8 miles before nightfall, reaching a deep rugged chasm which they had named, from their aerial surveys, Vee Canyon—one of several spots they had marked as a possible dam site. Making a second camp, they set up another X of driftwood and kept a smoking fire going all the time. Jaskar was becoming ill. Nevertheless, they spent two days studying and sketching the canyon. During that time Jaskar had eaten nothing but the little can of salted peanuts.

July 17, the day set for the search, came and went with no sign of plane or helicopter. A sudden hailstorm battered both camps, driving the men under the trees for shelter. Roberts began to wonder whether he hadn't by mistake set July 19 as the deadline. However, the rescue party had gone out on schedule. In an Alaska Airlines helicopter, Gene Lush of Anchorage, the pilot, and Edwin Stewart, a Bureau of Reclamation surveyor, were soaring over the Susitna, peering down at the canyons, the rocks and the rapids for some sign of the lost expedition. Suddenly they sighted a bright-red object on a sand bar below. Hovering lower, they recognized it as the wreckage of one of the boats. In fact, it was the one which Roberts and Johnson had been forced to abandon. They decided to land, and had sunk to within a few feet of the bar when the little ship went out of control. An instant later the huge main blades bit into the sand, bent backward and, still whirling like a great buzz saw, cut off the rear propeller, bent the main truss, and damaged the underside of the engine. Lush and Stewart climbed from the wreck, unhurt save for a bump on Stewart's head. Instead of being rescuers they, too, were stranded in the wilds.

BROWN BEAR
This beast is the largest carnivore in North America and, along with the grizzly, inhabits the area that was explored. Fortunately, having lost their guns, the men encountered neither creature, although they did see evidences of their presence. The picture was taken on Admiralty Island, Alaska.

There were now three groups isolated on the lonely river banks. Robbins, Swanda and Johnson were camping and fishing 23 miles upstream. Jaskar and Roberts were clambering over Vee Canyon 15 miles from the helicopter. And Lush and Stewart were ruefully taking stock of their predicament. However, before setting out over the Susitna wilderness, Lush had made arrangements for a search in case he failed to come back. Accordingly, on the next day, the 10th Air Rescue Squadron, famed Air Force contingent in the North, was notified that he was missing. A C-47 soon spotted the helicopter squatting like a great smashed beetle in the river channel. Word was sent back by radio, and within a matter of hours an Air Force helicopter came down safely beside the wreck. Stewart got aboard (there was room for only one passenger) and the helicopter went on downstream

on the chance of picking up some trace of the missing Reclamation party. As luck would have it they spotted the signals posted by Roberts and Jaskar and, landing, learned the whereabouts of the three other men.

Nothing more could be done that day. But on the next one, July 19, the helicopter returned and ferried Roberts and Jaskar, one by one, to nearby Fog Lake. There they were met by a float plane, which took them to the railroad point of Talkeetna, and thence a C-47 put them down, about 10 o'clock that night, in Anchorage. Four days later the three men who were still waiting at the base camp in Devil's Canyon also were picked up and flown back to civilization by helicopter.

The rescue had been accomplished with all men safe. But the Reclamation job still remained largely undone, and that didn't suit Roberts at all. The party had covered the stretch from Denali to the place where it was shipwrecked and had learned that there was nothing of interest in the 8 miles between that point and Vee Canyon. But in that gorge, Roberts and Jaskar had seen enough to realize that the site was worth further study. So on September 22 these two set forth on a second expedition, taking with them William Weber, a Reclamation engineer, in a helicopter piloted by Jack Zimmerman of Alaska Airlines. Their destination was Vee Canyon. As this was to be just a 2-day preliminary investigation, they carried along only some prepared lunches and their bear guns.

The ship landed on the bare top of a precipice jutting out into the river. There Roberts and Weber began to work, while Jaskar and Zimmerman flew over to the opposite side of the canyon. As the helicopter came down, one pontoon landed on a small mound, causing the ship to crash over on its side. In another moment its engine was blazing. The great blades, whirling for a time, gouged a trench in the tundra, throwing loose earth about the ground. With this the men, who had succeeded in scrambling out of the wreck, put out the fire. Then they looked at each other. "To hell with this country!" said Zimmerman. "I'm going back to test piloting."

From the canyon rim Jaskar and his companion signaled the news across to Roberts, who learned that for the second time he was on his own along the Susitna. Then they gathered what they could from the ruins of the helicopter—their weapons, four cans of sardines and a few flight rations. With these they struck off downstream to look for more food. Several miles away they came upon a hut barely high enough to protrude above the tundra grasses and brush which surrounded it. Nearby was a still smaller hut built on stilts like an oversized birdhouse. This proved to contain a cache of supplies, including a little coffee and tea, several cans of dehydrated fruit and some flour. There the two men decided to wait until they were rescued. The next day Zimmerman shot a partridge, but his heavy-caliber rifle, built to stop a bear, completely demolished the bird. There wasn't enough left of it to eat.

Meanwhile, Roberts and Weber were faring better. Hiking upstream, Roberts came to the site of the old shipwreck camp, where he found remnants of the food stock that had been left behind. Later he clipped the head from a partridge with a 300-grain bullet—a miraculous shot. Sighting moose and caribou, the men knew they would not want for food. However, they decided not to shoot big game until they needed it. As it turned out, that time never came. On the third day an Air Force plane spotted them and dropped notes, the following day a helicopter arrived, and in two trips all four were out.

The surveys still remained incomplete, but by now Roberts and his chiefs were convinced that exploration from the surface was an expensive and time-consuming procedure. The final reconnaissance was done completely by helicopter. The little ships could be set down on narrow ledges, where the men could gather rock samples, profile the canyons' sections, and take photographs. As a result of their persistence and courage, Vee Canyon has been proved to be a feasible site for a power dam. When they arrived at the base camp at Devil's Canyon they found that bears had broken into the cache and ruined the supplies—another reminder of the dangers they had escaped.

The wrecked helicopter of the first expedition was flown out piece by piece, destroyed parts were replaced, and it was in the air again within a month. However, the repair job cost $8000, and the instruments and supplies lost in the overturn of the boats came to another $4500. But all members of the party agree that these costs are small in view of the hazards and difficulties that were encountered and overcome—hazards that might easily have cost them their lives.

HEADS OF PARTY

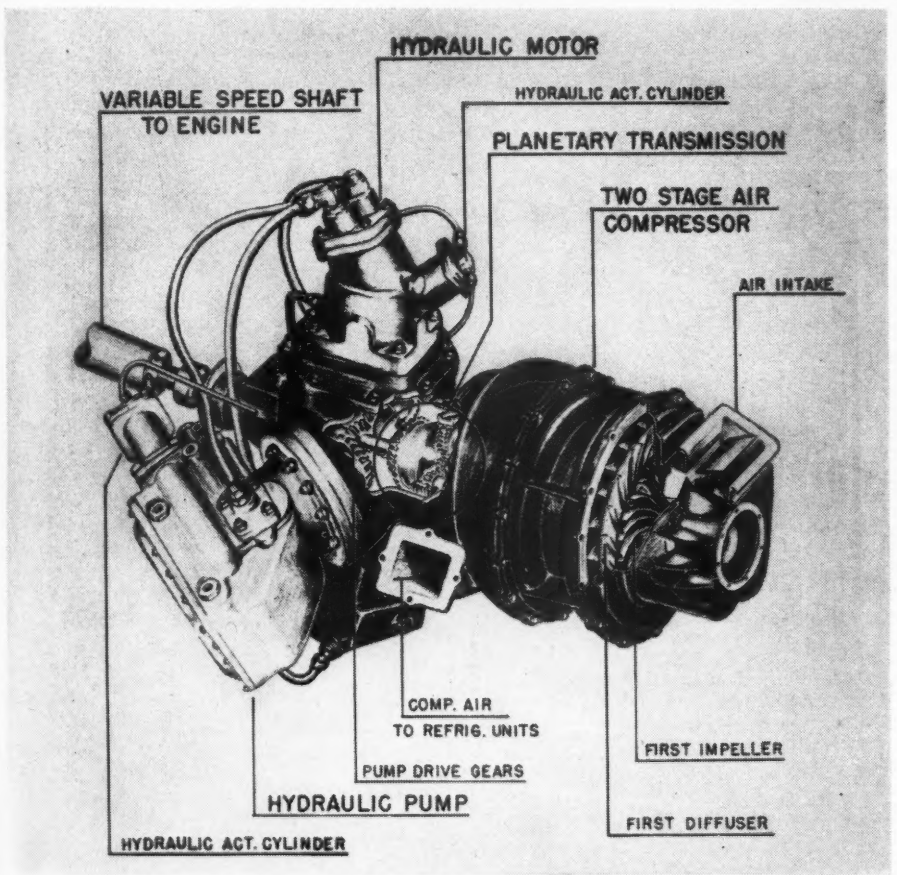
Daryl L. Roberts, left, chief of party, and Ade E. Jaskar, geologist, looking at a map of the section in which they spent some anxious days. At the right is Jaskar as he looked after several days in the wilds.

Air Equipment for Aircraft

Los Angeles Specialist in This Field Uses Compressed Air Liberally in Factory

Data and pictures from Compressed Air & Gas Institute

FACTORY DOORWAY
Entrance to AiResearch Manufacturing Company's plant in Los Angeles.



AERIAL-SERVICE COMPRESSOR
One of the firm's chief products, this 2-stage unit is designed to deliver a constant supply of compressed air to the pressurized cabin of a plane flying at high altitude regardless of the varying speeds of the aircraft engine from which it is driven.

IN FLIGHT and on the ground, compressed air is playing a vital part in today's — and tomorrow's — airplanes, as is so strikingly exemplified in the plant and laboratory of AiResearch Manufacturing Company, a division of the Garrett Corporation. This Los Angeles, Calif., concern makes impeller-type compressors, which provide highly compressed air for the pressurization of aircraft cabins, air-conditioning and refrigeration systems for airplanes, and cabin pressure regulators and other apparatus for controlling the air flow. These compressors are called superchargers, but should not be confused with the commonly known type of supercharger for engines. They are essential to the high-speed, high-altitude flight of present-day military and transport aircraft.

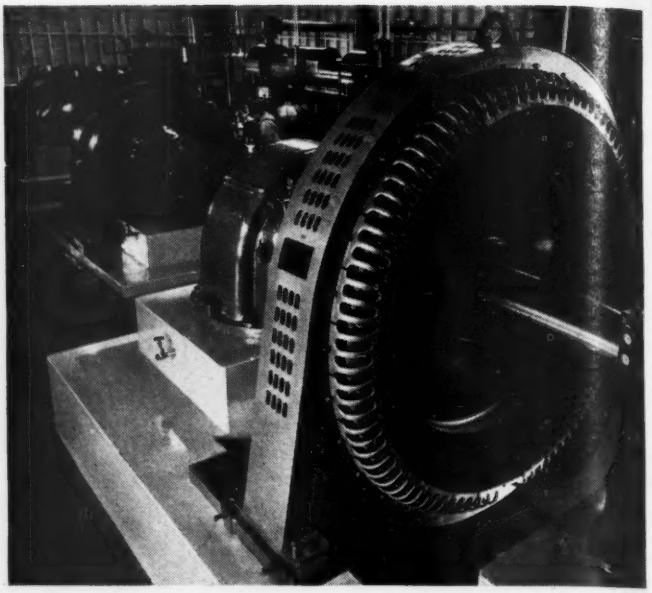
The development, production and performance of these air-conditioning systems depend largely upon stationary compressors of the type generally found in thousands of metalworking establishments, mills and other industries the country over, as the AiResearch Company's compressor installation proves. The factory and foundry air requirements are supplied by a central plant housing three horizontal units of 30-, 40-, and 75-hp, respectively. They have a combined displacement of 800 cfm and furnish air at approximately 80-psi pressure.

In the laboratory are three compressors driven by electric motors having a total rating of 1500 hp. These big machines have a capacity of 6800 cfm and deliver air at a pressure of 100 psi to run the numerous flow tests. It can be piped simultaneously or separately to twelve different test stands throughout the laboratory. There are also six vacuum pumps in service to simulate conditions prevailing at altitudes up to 75,000 feet by evacuating atmosphere chambers. Other tests of a similar nature also depend upon this battery of pumps, each of which has a capacity of 5000 cfm. They may be used separately, together, or in any combination, and are sufficient to maintain a 65,000-foot-altitude condition while handling a flow of 100 pounds of air per minute.

Through extensive research aimed at

STRATOSPHERE LABORATORY AND AIR SOURCE

In the bottom picture a technician is seen emerging from a chamber in which conditions are simulated like those prevailing in pressurized airplane cabins. A refrigeration unit for cooling a DC-6 airliner is shown under test directly below this caption. Compressed air for the laboratory work is supplied by three Ingersoll-Rand units driven by synchronous motors (right). They have a combined capacity of 6800 cfm at 100-psi pressure.



overcoming difficult conditions encountered in flight by the application of compressed air, the company has become especially aware of the potentialities of this adaptable power medium in everyday production. It takes advantage of the high and variable speeds of pneumatic screw drivers and wrenches in the case of dozens of operations, while the durability and dependability of these portable tools, together with their light weight in relation to high power at the point of work, further tend to step up output.

The laboratory adapts tools of this type for making certain tests of parts that must perform at high speeds in airplanes. The air motor of one of these tools, for example, will turn such a part up to 70,000 rpm while it is being checked by an interrupted light beam or similar apparatus. However, this is not the maximum rotary speed attained with compressed air. By means of it, a dollar-size 3-ounce disk is turned at the highest speed ever attained by a wheel—160,000 rpm. In operation in the cabin air-conditioning system of a plane, this disk must make 110,000 rpm. Many other parts are similarly tested

in whirl pits, which are evacuated to reduce air friction while compressed air turns the parts at great speeds.

The factory has countless other uses for compressed air. Air chucks on lathes save much of the loading and unloading time that would be consumed if those jobs were done by manual methods. For the same reasons there are air-powered collets on drill presses and other machines. Bench and machine work is frequently positioned by air-operated fixtures. Accuracy and time-saving dictate the choice of equipment in the case of each of these applications.

Free-action air also serves measurably to increase production. Air jets eject work from lathes, punch presses and other equipment. They also clean machines or dry parts quickly. Cleaning-tank fluids are agitated with air escaping from holes drilled in a pipe at the bottom of the container. Heat-exchanger tubes and assemblies which must be airtight are tested by introducing air under pressure and submerging them in water. Sandblasting and spray painting call for large quantities of compressed air. The plant's two spray booths are provided with four pressure pots, and ten regulators make it possible to control the pressure on the guns with ease to do a wide variety of painting jobs. Air motors agitate the paint in the pots.

Large doors on drying ovens and other equipment are readily raised and lowered by means of pneumatic pistons. Another lifting job delegated to compressed air is that in connection with a quench furnace. Beneath the latter is an air-hydraulic lift which instantly lowers the contents of the furnace into the quench and raises the load again at the right moment. It would be difficult to find more simple, direct and economical methods of doing all this work. There is no waste of space, motion or time, nor is more than the minimum amount of maintenance needed to keep everything functioning day in and day out.

The AiResearch foundry, like the factory, depends extensively upon compressed air. This modern specialty foundry makes precision castings of aluminum and magnesium. It is equipped with air-operated jolters, bumpers, vibrator tables, squeezers and other pneumatic devices. It also turns out centrifugal castings. As a safety measure in connection with the high-speed centrifuge, company engineers developed an air brake that can stop it quickly, if necessary, by means of piston-expanded bands.

Going from production to the laboratory discloses other applications which give further evidence of the manifold ways in which compressed air serves industry. In addition to the compressors and vacuum pumps previously mentioned, the $5,000,000 research plant has strato, heat-transfer, hydraulic, dynamometer, expansion-turbine, electrical and metallurgical laboratories, as well as whirl test pits.

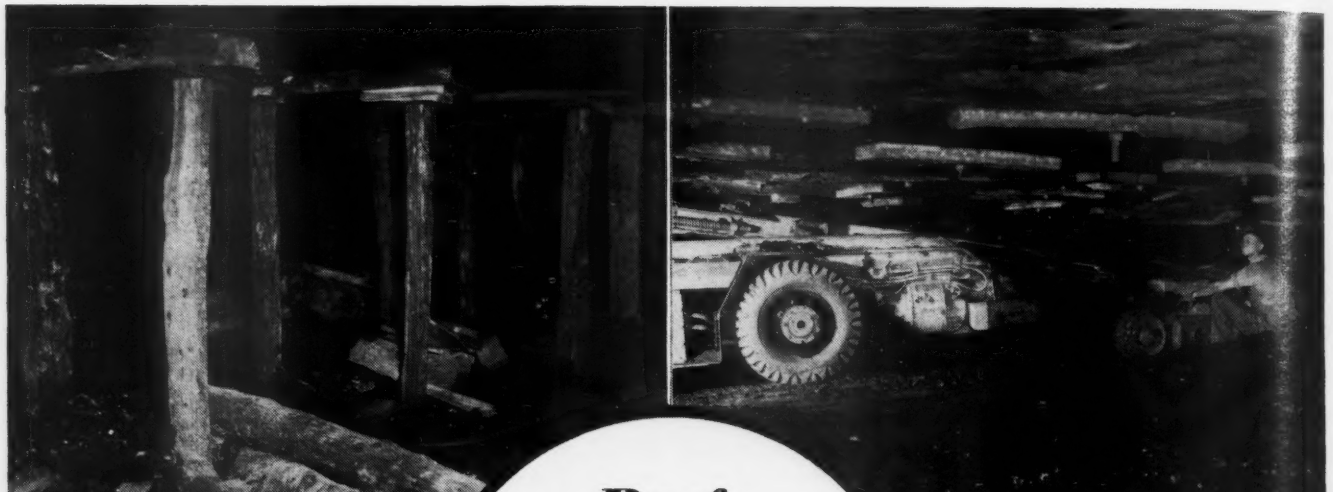
Virtually every section of this large layout depends upon compressed air in one way or another. In the strato lab, for instance, there is a chamber large enough to house an aircraft fuselage. Adjoining it is another, which duplicates a sealed airplane cabin accommodating six passengers who ride comfortably while climbing and diving at the extreme speeds of a jet fighter. These accurately simulated conditions of flight are accomplished by evacuating the chambers to a point where the air is as rarefied as that met at high altitudes while at the same time pumping in compressed air in sufficient amounts, controlled by pressure regulators, to counteract stratosphere conditions.

There are hot and cold tunnels where speed conditions for testing heat-transfer products are simulated by blowers capable of creating winds of hundreds of miles an hour. The temperature of the air can be varied from 70° below zero to 260°F, while heat caused by the friction of speeding jet planes, around 600°, is provided by furnace-heated compressed air. Air-expansion cooling turbines coupled to heat exchangers reduce the temperature of this hot air to 30° for cockpit comfort.

Still other tests are conducted in the various sections of the laboratory with compressed air, and indications that this medium will in future perform more functions in airplanes than it does today is found in the company's new research facilities for testing pneumatic power drives for aircraft application.

USES OF AIR TOOLS

Shown at the left are the remains of a supercharger impeller that ruptured and shattered the wooden lining of the test chamber while being whirled at 40,000 rpm. Using the motors of pneumatic tools, the test department gives some parts rotational speeds up to 160,000 rpm. A more prosaic use of a pneumatic tool—breaking up the sand mold of a casting with a chipping hammer—is illustrated at the right.



Roof Bolting

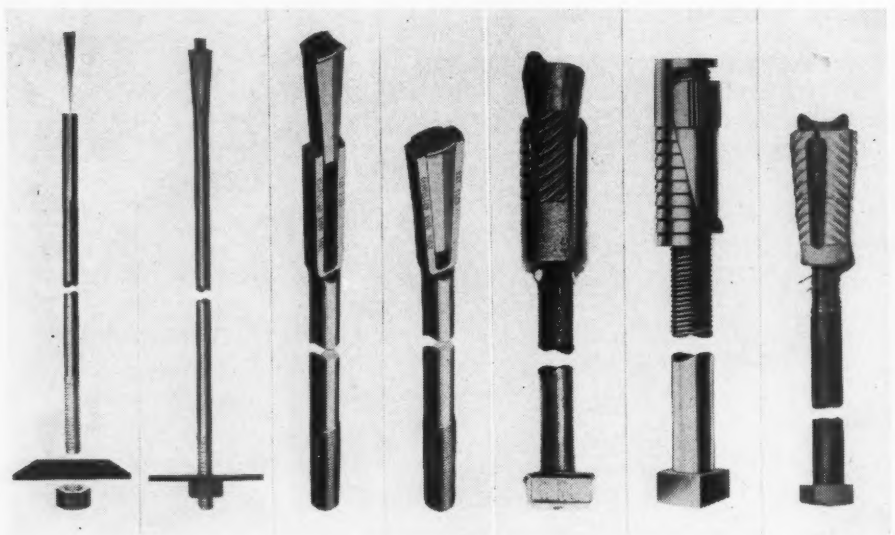
U. S. BUREAU OF MINES PHOTOS

STRIKING CONTRAST

Scenes before and after roof bolting in the Alabama Power Company's Gorgas coal mine tell the story of the advantages of suspension roof supports. Slabs of lumber, such as the 2x6-inch sections shown above, are frequently incorporated in roof-bolt assemblies where the rock sloughs badly and in working areas soon to be abandoned. Often the wooden plates are used only where galleries are wide. In narrower places, such as haulage entries and air courses, the smaller metal bearing plates are utilized. Where openings are to serve for long periods the lumber would rot and permit roof falls.

ROOF bolting, which is also called roof pinning and suspension bolting, is a new, safe and efficient method of supporting the roofs of mine workings. It is used in many places instead of conventional timber posts. Miners, who were first given to jesting over the unique method, dubbed roof bolts "sky hooks" and referred to their application as "pin-up timbering." The more pessimistic discredited roof bolting as a ridiculous theory and compared it to "holding oneself up by one's bootstraps." Time and trial have won advocates. Patience and research have eliminated many of the flaws made in putting them in place. In mid-1951 roof bolts were being manufactured in the United States at the rate of two million a month, conclusive evidence that the practice is winning favor.

Who is responsible for this means of support? Its origin is vague and apparently no one person or mine is seeking credit for the idea. Many old-time mining engineers and operators confess that it had occurred to them when encountering heavy ground that it would be fine if they could just bolt that roof up there and eliminate those expensive posts that always seemed to be obstacles to efficient operation. But they either shrugged off the thought as fantastic or they were too busy getting "rocks in the box" to give the idea a trial. General use of the method is less than five years old, but a few scattered applications were made more than 40 years ago. The St. Joseph Lead Company has installed roof bolts for 24 years in its southeastern Missouri mines, but officials of that concern are not sure which of their employees introduced the idea.



TYPES OF ROOF BOLTS

Bolts are of two general kinds: the slit-rod-and-wedge and the expansion shell type. The first-mentioned are either made on the job (first two, left) or purchased (second two manufactured by Cleveland Hardware Company). In either case, when the bolt is driven up into a drilled hole, the wedge spreads the upper end of the rod so that it grips the rock firmly. From left to right, the three expansion-type bolts shown are made by Ohio Brass Company, Hubbard & Company, and Westinghouse Electric Corporation. As the name implies, the upper section expands when the rod is screwed into it.

Those pioneer applications were not publicized until W. W. Weigel broke the ice with his article on the use of bolts with channel-iron bearing plates in St. Joseph Lead mines in the May, 1943, issue of *Engineering & Mining Journal*. Even then the practice was not considered seriously in the mining field generally. In 1947 the U. S. Bureau of Mines saw in suspension supports an answer to some pressing coal-mine roof problems. A steel shortage at the time delayed adoption, but the Bureau, through its new Roof Control Section, went ahead with study and limited trial. Operators applied the method when they learned about it and when steel became available. By 1949 the practice had spread from collieries to iron, lead, zinc and other classes of mines. Percentage-wise Alabama has taken the lead in the development, adapting it to both coal and iron mines. Most of the major coal-producing states such as West Virginia, Kentucky and Ohio are becoming

large users of this means of roof support. In September of this year the Pennsylvania legislature authorized its introduction in the anthracite workings of the state.

It was reasonably easy to understand the practicability of the bolting operation where it involved fastening and consolidating a fractured seam or a loosening block of rock in the roof to an overlying solid formation. But it has taken time and research to fully comprehend and test the mechanics entailed in strengthening a dangerous roof by bolts, or bolts with bearing plates, inserted directly in such a roof member. There are many such applications, and records prove that they are entirely satisfactory.

Actually, the process calls for the use of reinforcing material to provide additional beam strength to roof sections —to consolidate them. The roof is likened to a beam across a mine-opening span. If the span shows weakness it can be reduced to several smaller ones by introducing rigid supports, that is, roof bolts, thus lessening the likelihood of failure through weaknesses developing along bedding planes and fractures in the roof rock. Edward Thomas, chief of the Bureau of Mines' Roof Control Section states: "Experience has shown that even though we anchor our bolts in solid ground such as a massive bed of sandstone or limestone or even the igneous rocks, a plane of weakness is induced through the pressure applied to the anchor point of the bolt which is similar to the plane of weakness set up by wedge and feathers in quarrying operations. For this reason one can depend only on the thickness of the strata actually penetrated by the bolt to form a beam across a mine opening."

The advantages incident to replacing conventional timber supports with roof bolts are many: Freedom of access makes for operating efficiency, particularly at the working face and in mechanized mines. Greater safety is enjoyed, especially at headings where conventional props are easily dislodged during mining. Blasting doesn't knock down roof bolts. Ventilation is appreciably improved by removal of the resistance offered by a multiplicity of posts to the air flow. Good housekeeping, which promotes safety as well as efficiency, is easy with open passages made possible by roof bolting. Cost of handling and installing the supporting elements is less. Large storage space required for bulky timbers is done away with. Suspension bolts usually need no attention throughout the life of a mine. And last, but not least, research findings are pointing to the feasibility of wider mine openings with their greater economic advantages.

An early objection to roof bolting, and one that somewhat retarded its use, was the high first cost of the supporting material; that is, bolts and bearing plates were more expensive than timbers in certain localities. But this drawback has been largely offset in the meantime by the resultant benefits—by the more efficient and safer operation under roofs strengthened by suspension bolting.

Miners are warned that there is no standard method of application. Each mine has its own peculiar roof condition, and each section must be dealt with as an individual problem. Qualified engineers should be consulted in each case, for improper installations can be extremely dangerous.

Research is keeping pace with the rapidly widening use of this new device. Industry and government agencies are aware that much can still be learned in the field of roof support. Different means of anchoring are continually being tried, and varied schemes of suspension are being tested under identical roof conditions. Many innovations are under study, including grouting bolts in place to increase the bond between steel and rock; grouting holes with cement as a substitute for bolts—the cement to fill crevices and to prevent initial rock alteration and slough; and replacing bolts with wooden pins with a slot and wedge at each end. Applying force to the wedge protruding from the hole in the roof expands that end; and forces the top wedge against the base of the hole, thus expanding that end of the pin and anchoring it doubly.

TIGHTENING BOLTS

There are several uses for pneumatic tools in roof-bolting operations. The holes are usually drilled with stoper-type rock drills. Slit-rod-and-wedge bolts may be speedily driven into place with pneumatic hammers. An impact wrench will screw the rod of an expansion-type assembly into the shell with the exact degree of tightness wanted. Finally, the same tool will tighten the nut that holds the bearing plate in position (an Ingersoll-Rand Size 514 impact wrench is shown doing it here).

IRON-MINE APPLICATION

Visualize the operating difficulties that would be encountered here if a return to old-fashioned post supports became necessary. This ore-loading scene in one of Tennessee Coal, Iron & Railroad Company's iron mines near Bessemer, Ala., is a study in roof-bolting technique. The small bearing plates, which prevent the rock surface from disintegrating when surface tension is applied to the bolts, provide all the bearing necessary where the exposed rock does not spall or flake.

Diamond Bits with Improved Cutting Surfaces

THAT diamonds on miladies' fingers have soft spots on their surfaces is not a generally known fact, though the crystallographic explanation of the phenomenon was made public in 1939. Gem cutters and polishers have been aware of this nonuniform hardness characteristic of the prize among precious stones for generations and have taken advantage of it professionally. The same thing is true of industrial diamonds, commonly called bort, which perform an important service as a cutting agent in core-drill bits.

To facilitate cutting and polishing, lapidaries avoid the harder planes of the diamond in their efforts to produce dazzling stones. Now, U. S. Bureau of Mines engineers are doing just the reverse to give exploration crews a more efficient diamond-drill bit with which to extract cross sections of the earth's crust in quest of minerals or to determine the nature of the formation.

Albert E. Long, chief of the diamond-bit research and diamond-drilling consulting service of the bureau's Mining Research Branch, Minerals Technology Division Region VIII, has written a report, entitled *Diamond Orientation in Diamond Bits, Procedures and Preliminary Results* (Investigations 4800), on the findings of a research project that was started in the early fall of 1949 and is still in its infancy.

The work is under the direction of Wing G. Agnew, chief of the Mining Research Branch, at the government's Mount Weather Station at Bluemont, Va. Equipped like a full-scale mine to carry on a host of experiments under hard-rock conditions, the tests are being conducted with standard diamond drills. The rock chosen is a saussuritized dacite porphyry which occurs in a uniform and even-textured dike or sill some 30 feet in thickness in a section of the Mount Weather adit. From a diamond-driller's standpoint it is somewhat similar in hardness to fine-grained granite.

In attacking the preliminary aspects of the problem, Mr. Long became convinced that the key crystallographic characteristics of bort were recognizable and that the diamonds could be oriented in a bit mold so that their harder surfaces could be used as cutting points. Three bits were set with Congo-grade diamonds: in one the soft-vector directions of the stones were exposed; in another the stones were mounted at random, as is the common practice; and in the third bit the bort's hard-vector planes were the cutting faces. The results obtained are shown in the accompanying table from Mr. Long's report.

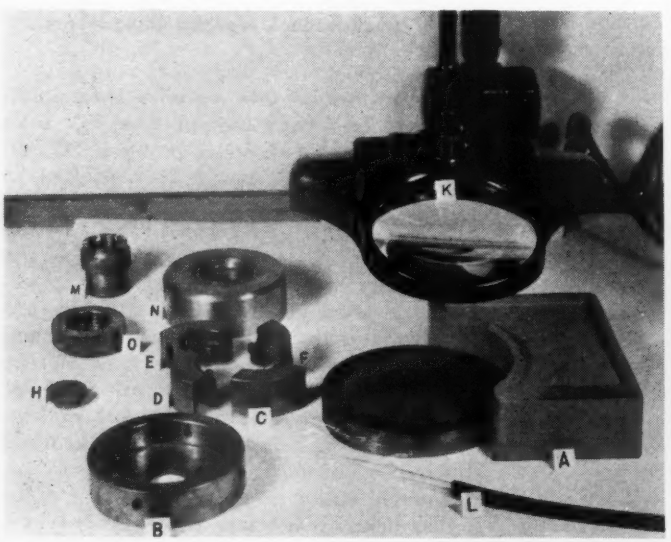
So revealing was the outcome that further tests to extend over a period of years were planned to determine positive trends and to remove all possibility of accidental coincidence or error in the initial work. Procedure and conditions with standardized equipment were carefully considered prior to starting these experiments, and they are being closely adhered to in each series of tests made. Control and metering devices are applied to the drilling operations so that all conditions can always be duplicated. Air for the power unit of the diamond drill is maintained at 80 psi; the volume of water circulated through the drill rods and past the bit face is held at 5 gpm and at a pressure of 50-60 psi; and the drill-feed gear is set for a definite rate of penetration. Many other precautions are being taken, as the following list from Mr. Long's report shows, "to insure smooth operations and to eliminate undue stresses on the experimental bits."

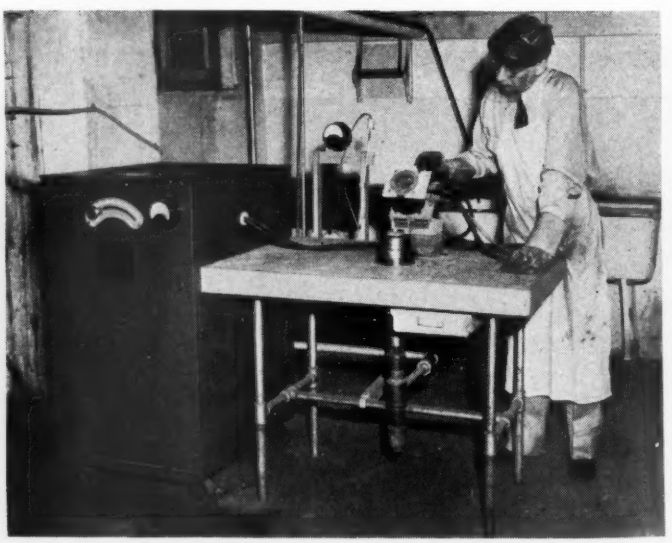
1. Rod vibration is not tolerated, rods are kept well-greased with dope, and any piece of equipment that develops a flaw or becomes worn and out of balance is replaced immediately.

2. Experimental bits are never used in collaring a hole; bits used for collaring holes are utilized to start a new hole and drill through the greenstone and into the saussuritized dacite porphyry layer.

3. At no time is an experimental bit permitted to run over broken core or started on a dirty bottom.

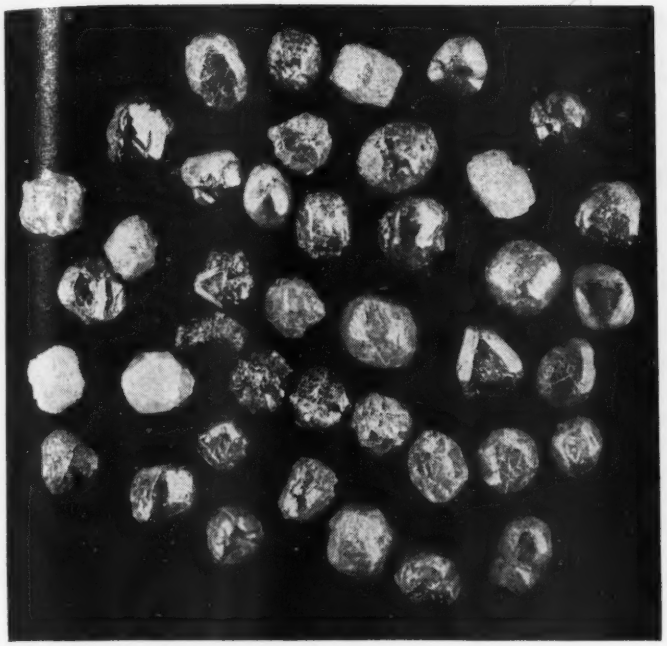
4. If a block occurs, which rarely happens in the uniform test rock, drilling is stopped immediately, the block is removed, and the hole cleaned out





DISASSEMBLED MOLD AND POURING METHOD

The first step involved in mounting and casting diamonds is to assemble and place the six mold pieces *B*, *C*, *D*, *E*, *F* and *H* on the setting plate under magnifying glass *K* and to select, weigh, and put the stones in tray *A*. The operator then picks up a diamond with vacuum pencil *L*, examines it under the glass, and orients it in one of the holes in the mold, where it is held by suction created by a vacuum pump. When all the diamonds are in position, they are sprayed with a quick-drying plastic solution having a low combustion point. Next the mold is taken to the casting room where bit blank *M* is locked by part *O* in *N* and placed on the casting plate, which is also connected to a vacuum pump. The alloy or matrix is melted in a small pot heated by induction and is poured into the mold, suction being applied at this stage to draw in the metal and to hold the diamonds in position until the alloy has solidified. That done, the mold is quenched in a water-filled container. When cool, the casting is removed, cleaned, machined on a lathe, and waterways are cut in the crown of the bit. If desired, the finished bit may be heat-treated at this stage to increase the hardness of the matrix.



MAGNIFIED FOUR TIMES

Industrial bort of the type used in the preliminary Mount Weather Station tests. These are from the Congo of South Africa and are ready for mounting. About 148 were set in the crown of each bit and ranged in size from eight to twelve stones per carat. They were selected indiscriminately from a single batch purchased from a supplier who had picked them out from a single lot, thus eliminating one possible source of difference between the diamonds.

FINISHED BIT

An AX-size coring bit of the type used for the experimental work. Note that the diamonds are set not only in the foremost cutting surface but also well down on both the outer and inner sides of the crown. The matrix in which the stones were cast was either nickel with 0.69 percent chromium and 2.66 percent beryllium or copper with 3.96 percent beryllium, the latter metal predominating. But in any one series of tests the matrix was uniform throughout.

before drilling is resumed. Grinding of core with an experimental bit is not permitted.

5. Collaring bits and reaming shells are replaced before their OD is reduced to the point where the experimental bits would have to be reamed into a test hole.

6. Gradual acceleration and deceleration of the drill is always practiced.

7. An experimental bit is never started from a dead position in contact with the bottom of a hole.

8. To eliminate one chance of jamming the 5-foot core barrel, only 4 feet is cored between pulls.

9. All experimental bits are run in closely spaced near horizontal trending holes for a distance of 20 feet. The number of 20-foot intervals required to test each bit depends on how quickly it becomes dull.

Though the outcome of the investigations now in progress will not be known for some time, the showings made by the preliminary diamond-drill tests are so promising that they may start a revolution in the bit-setting industry and among drillers who set their own bits. They indicate, to quote Mr. Long, "that a substantial saving in diamonds may be effected by using the harder areas of the stones as working surfaces in the crown of diamond bits, that the drilling performance of the bit is increased, and the diamond loss per unit of work done is reduced." Further, it was found that it took less than twice as long to orient the stones in a bit mold in hard-vector directions than to set them in random fashion. All this bears out the belief expressed by Dr. James Boyd, director of the Bureau of Mines, when he first studied and approved the project for the purpose not only of conserving industrial diamonds but also of increasing the efficiency of the diamond drill.

VECTOR ORIENTATION

	Soft	Random	Hard
Number of stones in each bit	148	148	148
Number of stones per carat	8–12	8–12	8–12
Number of carats per bit	14.370	18.110	15.350
Percent of stones oriented in hard-vector directions	22	36	84
Feet drilled per bit	59.300	75.200	84.100
Average rate of penetration, inches per minute	2.700	3.010	3.070
Diamond loss per bit, carats	3.410	1.210	0.450
Diamond loss per foot drilled, carats	0.058	0.017	0.005
Percent of salvaged bort which was resetable	76	93	97
Cubic feet of air used per foot drilled	1065	934	915

Novel Radiant-Heat System

THOUGH there is nothing new about the use of radiant heat to keep sidewalks, loading platforms and the like free of snow and ice, the system installed for this purpose at the South Milwaukee plant of Bucyrus-Erie Company is novel. Ordinarily, radiant heat is generated by circulating hot water through a gridwork of piping embedded in the concrete, but in this case flexible, lead-covered heating cable serves the purpose.

About 40,000 feet was laid on approximately 3-inch centers on wire mats about 2½ to 3 inches below the surface of four concrete crane and transport runways. Each is about 10 feet wide and from 100 to 275 feet long. In order to provide the correct voltage for these nonstandard lengths of cable, the General Electric Company, which supplied it, had to build special step-down transformers. For the shortest trackway this secondary voltage is around 180 and for the longest, 500.

According to officials of the company, the radiant-heating system was subjected to its severest test late last winter after a week-end snowfall. Even though the temperature outside registered 11° below zero Fahrenheit, the runways were clear in a few hours. Tile drains were placed along the edges so as to provide adequate runoff for the melted snow.

Man Versus Gophers

CHAMPION GOPHER KILLER
William A. Batzner, who wages a one-man war on gophers, exhibiting some of the rodents he hates intensely.

A FULL-GROWN, healthy gopher can dig as much as a mile of tunnel in a year, according to some authorities. If that mile of boring is done in a ditch or canal bank on irrigated farmlands, one gopher can be responsible for water leaks that lead to property and crop damage running into thousands of dollars. And gophers seldom operate alone — they believe in large families. The pest would thrive on irrigation projects in the western United States except that the Bureau of Reclamation and farmers wage a relentless battle to exterminate them.

A champion gopher killer has just been acclaimed. He is veteran William Adam Batzner of the Notus, Idaho, Bureau of Reclamation field office. Batzner won his championship by mixing with his sincere hatred for the rodents calculated portions of calcium cyanide and compressed air. His ingenuity and his desire to find a way to kill more gophers led him to discard the traps he had used for years to account for some 5000 gophers and turn to mechanized exterminating equipment.

Batzner's first chemical attack on gophers was not very successful, however. His scheme was basically one of poisoning the burrowers by forcing calcium-cyanide powder into their runs with a hand-operated air pump. The powder, upon exposure to the moisture of the tunnels, releases hydrocyanic-acid fumes which kill gophers instantly. But the self-preservation instinct of the animals had not been reckoned with. Apparently, the first few strokes of the pump changed the air pressure in the burrows sufficiently to serve as a signal to the rodents that something was after them. They hurriedly threw up earth bulkheads as a protection from the slow-moving cloud of fumes.

Batzner decided he must apply the poison in a continuous stream and with such force that it would reach the limits of the burrows quickly. He found an idle air compressor, mounted it on the back of a jeep, and attached 50 feet of ¼-inch rubber hose. Compressed air now carries the fumes through the passages at a rate of 100 feet per minute with no warning pulsations. At greatly decreased cost and effort, Batzner now kills more gophers than he could with traps, and in approximately one-sixth the time.

GOPHER DAMAGE
Water flowing through a gopher burrow in the bank of an irrigation canal enlarged it into a break and caused this extensive erosion, which will be expensive to repair.

INSERTING LETHAL NOZZLE
When in actual use, packing of some sort is put in the gopher hole to keep the gas from escaping. Compressed air is introduced by pressing a button in the line. Powdered cyanide is placed in the chamber, which Batzner made from a 6-inch length of 3-inch pipe welded shut at one end and closed with a screw cap at the other. At the right is an interior view showing the jet (left) that admits the air. Mixing with the powder, it carries controlled amounts through the small hole at the right and thence through the hose to the nozzle.

Ceramic Sandblast Nozzles

SAND or shot, hurtled at high velocity by a stream of compressed air, is very effective in cleaning metal surfaces and in etching and carving glass or stone. Nozzles for directing the blast have traditionally been made of metal, ranging in composition from cast iron to such indurate materials as tungsten and boron carbides. The choice normally depends upon the nature of the service.

Carbide nozzles are comparatively costly but may, at the same time, be economical because they are relatively resistant to wear. Consequently, they are often selected for heavy-duty work, especially where the material exposed to the blast is valuable enough to warrant their purchase. For run-of-the-mill operations, however, lower-cost nozzles predominate, and those of cast iron have probably been used most extensively.

We recently came across the surprising fact that durable nozzles are now being made of ceramics. Even more astonishing is the report that one of them will outlast from six to twenty cast-iron nozzles, depending upon the abrasive employed. The Frenchtown Porcelain Company, of Frenchtown, N. J., developed the first ceramic nozzles, which came into being as a sort of by-product. The firm's leading product is ceramic insulation for automotive- and aviation-engine spark plugs. It is made of varying compositions to meet different service demands. During World War II, manufacturers of the Rolls-Royce Merlin aircraft engine sought an insulator that would withstand the intense heat and abrupt temperature changes to which it was subjected and retain electrical resistance at elevated temperatures. The Frenchtown concern succeeded in filling the requirements with a high-alumina-content material which it designates as Body 4462.

In making spark plugs, the specified ingredients are mixed, moistened, worked into a homogeneous plastic condition and then subjected to a vacuum to remove entrained air. The resultant material, of a stiff-mud consistency, is extruded in the form of a continuous round rod having a diameter equal to the maximum section of the spark-plug insulator. The rod is cut into pieces of the desired length, and each is pierced to provide the central longitudinal opening. Then it is machined to its final shape by turning it at high speed on a small lathe much as a piece of metal is shaped. The pieces are finally glazed and fired at the proper temperature.

The material removed during the piercing and machining operations cannot be satisfactorily reworked into spark plugs, and it was while seeking some other use for it that the Frenchtown staff came up with the sandblast-nozzle idea. Experiments disclosed that the material was highly suitable for that purpose. Thus a new product was born.

Material 4462 is an outgrowth of research conducted in Germany during World War II. In their efforts to improve spark-plug insulators, the Teutons sintered aluminum oxide. As soon as American ceramic technicians learned of this development they began working along the same lines and eventually succeeded in developing compositions of high alumina content that exceeded anything the Germans had turned out.

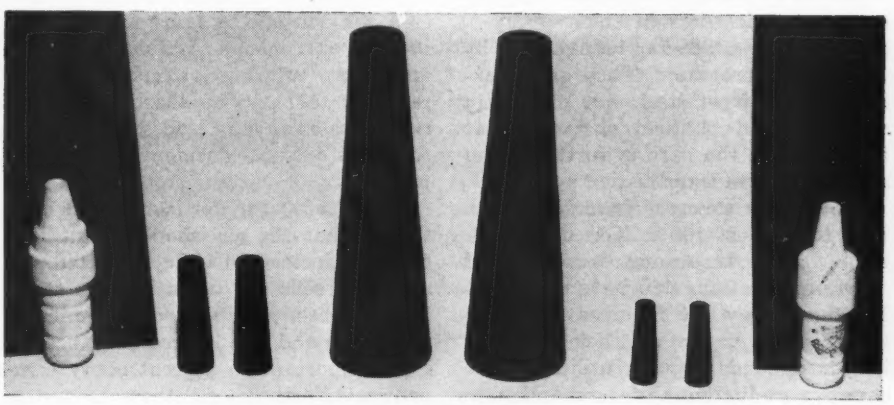
In one of its natural forms, aluminum oxide is the mineral corundum, which ranks next to the diamond in hardness. The Frenchtown material contains 94 percent of the oxide and, after firing, attains a hardness of 9 on Moh's scale, which is equal to that of corundum. This undoubtedly contributes to its serviceability in sand-blast nozzles, although hardness alone does not always insure resistance to abrasion. For some applications, for instance, soft rubber stands up better than most metals. Body 4462 has a specific gravity of 3.876, a tensile strength of 15,500 psi and an ultimate compressive strength of 187,100 psi.

The aluminum oxide processed at Frenchtown is the same white sugarlike powder which aluminum producers obtain by refining bauxite and which is the raw material they use in making metallic aluminum. In fact, the powder is purchased from one of the leading aluminum companies. As received, it is not fine enough for the intended purpose, so it is ground to the proper mesh. This is necessary to obtain a final mixture of the right density that will bring about the wanted vitrification and have the other essential properties. The actual forming of the nozzles follows the same procedure outlined in the case of the spark-plug insulators. Because the material shrinks about 14 percent during firing, pieces are made that much oversize to allow for reduction. The firing temperature is 2700°F.

Designated as the Pyramid ceramic nozzle, the Frenchtown product is sold exclusively by George Pfaff, Inc., a distributor of various materials for abrasive blasting, with headquarters in Long Island City, N. Y. Tapered nozzles are available in three sizes, and there is also a shoulder-type unit that fits several standard sandblast cabinets. The largest tapered model, just under 4 inches long and suitable for general industrial work on metals, has orifices ranging from $\frac{1}{8}$ to $\frac{5}{16}$ inch. It weighs less than 5 ounces and is therefore easier to handle than the heavier metal nozzles. The two other tapered units are much smaller, and are designed for the glass- and stone-carving trades. One is $1\frac{1}{4}$ inches long and has an orifice of $\frac{1}{16}$ or $\frac{5}{32}$ inch, and the other is a little less than an inch long, with a $\frac{3}{32}$-inch orifice.

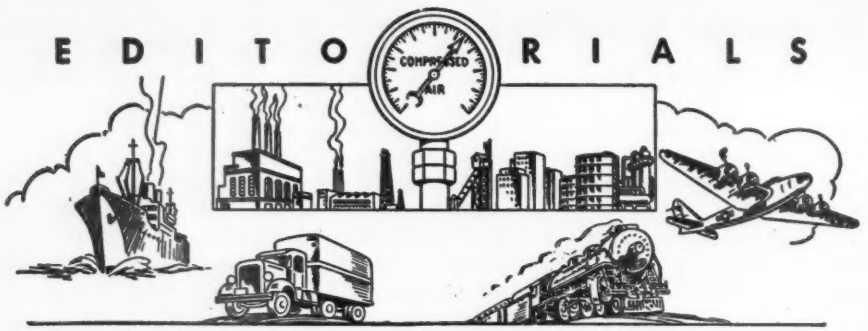
Experience has shown, according to Mr. Pfaff, that the biggest of the nozzles will outlast cast-iron nozzles on an average ratio of 6 to 1 when blasting with aluminum-oxide abrasive, 10 to 1 with sand, and 12 to 1 with steel grit. The two smaller sizes, which are mainly used with a very fine-textured abrasive for decorating vases and mirrors, have been found to be about twenty times as durable as those of cast iron.

In an effort to discover additional applications for Body 4462 material, the Frenchtown Porcelain Company has enlisted the services of the Stanford Research Institute of California. Suggested uses include such products as inserts for nozzles of rockets where the material must withstand erosion from the blasts of intensely hot gases, brake liners for jet bombers, air nozzles for rotary oil burners, radar noses for guided missiles, dies for drawing wire, tools for cutting soft metals, and crucibles for holding molten metals. Further, it is proposed as a replacement for glass now used in making envelopes for electron vacuum tubes and high-voltage vacuum capacitors.



TAPERED NOZZLES

Shown here are three sizes of ceramic nozzles for hand-held blast outfits. Pictured at either end are insulators for spark plugs from which sandblast nozzles evolved as a by-product.



GAS RUSH HIATUS

THE year 1849 ushered in a series of gold rushes in the West. A century later we have been witnessing a gas rush, mainly in the East. Since World War II ended, no less than eight monster interstate pipe lines have been built to carry natural gas from the Southwest to the North and Northeast, and one line has gone westward to the Pacific Coast. Within the past year, natural gas has come to New York City, the nation's largest metropolis. Such terms as "big inch" and "super inch" have become familiar to almost everyone. Some of the lines are still creeping forward, still expanding, and by the time they stop there won't be a city of any importance east of the Mississippi and north of the Ohio without a supply of the fabulous new fuel.

But, we are told, the honeymoon is over for huge interstate gas transportation systems. At least, that was the concensus of natural gas men who met in Oklahoma City a few weeks ago. In their opinion, no new lines crossing state borders are likely to be built for some time to come, although existing ones will doubtless be extended from time to time or increased in carrying capacity by laying stretches of paralleling lines known as "loops."

Their predictions are not based, as might be supposed, on an impending shortage of steel for pipe. Actually, they say, enough steel could probably be procured to string another line from Texas to the eastern seaboard. In any event, the tightness in steel supply is a temporary condition brought on by the defense program. They are thinking, then, not of steel, but of certain economic and political obstacles that have risen in the path of further large-scale interstate transmission systems.

One barrier concerns financing, which runs to at least 100 million dollars for each system. Insurance companies and other organizations that have been lending the money are reported to be no longer eager to tie up their funds in long-term bonds of public utilities whose earnings are limited by federal and state actions.

Another stumbling block is the mounting difficulty of obtaining the huge volume of gas required. Before the Federal Power Commission will issue a construction permit for an interstate line, it must have proof that the applicant has arranged for sufficient gas to operate the line at capacity as long as may be required to pay off the investment.

Up to now it has been relatively easy to contract for the volume of gas needed, but this is no longer true. Most of the remaining unpledged large gas deposits are owned by the oil companies and they are not anxious to deplete them, especially at current prices. Most of the long lines now operating bought gas originally at from 2 to 5 cents per 1000 cubic feet and some of them are paying no more than 4 or 5 cents now. However, a promoter seeking gas today would have to offer 8 or 10 cents or even more to get the average owner interested. Oklahoma and Kansas have both set minimum prices of 7 and 8 cents on gas at the well head and other southwestern states are considering taking similar action.

It is likely that most gas purchase contracts signed in the future will carry escalator clauses providing for increases in the prices to keep abreast of an inflationary economy. Gas carriers are limited by law to a return of 6½ percent on their investment after charging off depreciation. The only way they can combat rising gas and operating costs is to raise rates and it takes time to get the necessary permission. Right now applications for increases aggregating around 100 million dollars annually are before the Federal Power Commission for action. As rate increases go into effect, consumer resistance stiffens and some transmission companies are reported to be worried even now that rising gas costs may lead to rate boosts that will detract considerably from the popularity of natural gas fuel.

Still a further factor is a growing sentiment that the gas should be utilized at home instead of being exported. If an owner sells his gas in his own state, he escapes the possibility of Government regulation and this is becoming increasingly important to a great many companies. Furthermore, there is a pronounced movement of industries to states that are rich in natural gas. Foremost among them are the petrochemical concerns that utilize the gas not only as a fuel but also as the raw material for manufacturing various synthetic products. During the past 18 months expenditures for such plants have aggregated 300 million dollars and it is reported that local industries now consume between 5 and 10 percent as much gas as is sent out through the transmission lines.

All of this adds up to the prospect that users of natural gas in the northern latitudes are going to pay gradually increasing rates for it; that new lines will be built sparingly during the foreseeable future; and that existing lines will reach limits beyond which they cannot take on additional customers. There is, of course, always the possibility that unexpected discoveries of additional large gas reserves will change the outlook materially.

•

BUY CHRISTMAS SEALS

ONE out of every five persons in the country becomes infected with the tubercle germ. Of those infected, one in 50 develops tuberculosis. Of those diseased, one in ten dies. In 1900 tuberculosis was the second greatest cause of death; by 1940 it had declined to seventh and there were predictions that it would be virtually eradicated by 1950. That, unfortunately, has not come to pass. There are some 500,000 people in America who have tuberculosis, but only half of them are aware of it. The others are losing their own health and menacing that of others whom they may infect. It is highly important that they be located, diagnosed and placed under treatment.

The battle against tuberculosis is carried on by many organizations, but none is more active than the National Tuberculosis Association which, with its 3000 affiliated associations, is financed by the sale of Christmas seals. Since 1907 these sales have yielded 265 million dollars and the funds have contributed notably toward saving many lives that would otherwise have been lost.

This money is used not only for actual treatment of tubercular people, but also for research designed to develop more effective methods of treatment. It is now well known that a patient does not have to change climate but can be cured in a hospital near his home. Bed rest is still considered the imperative first step and may in some cases be all that is required. More resistant cases call for drugs or surgery or both. Streptomycin, which inhibits the growth of the tubercle bacilli in the body, is the most effective drug thus far discovered.

Americans do not have to be urged to buy Christmas seals. They need only to be reminded. This is your reminder. Get them today!

This and That

Finder of Canadian Mine Dies

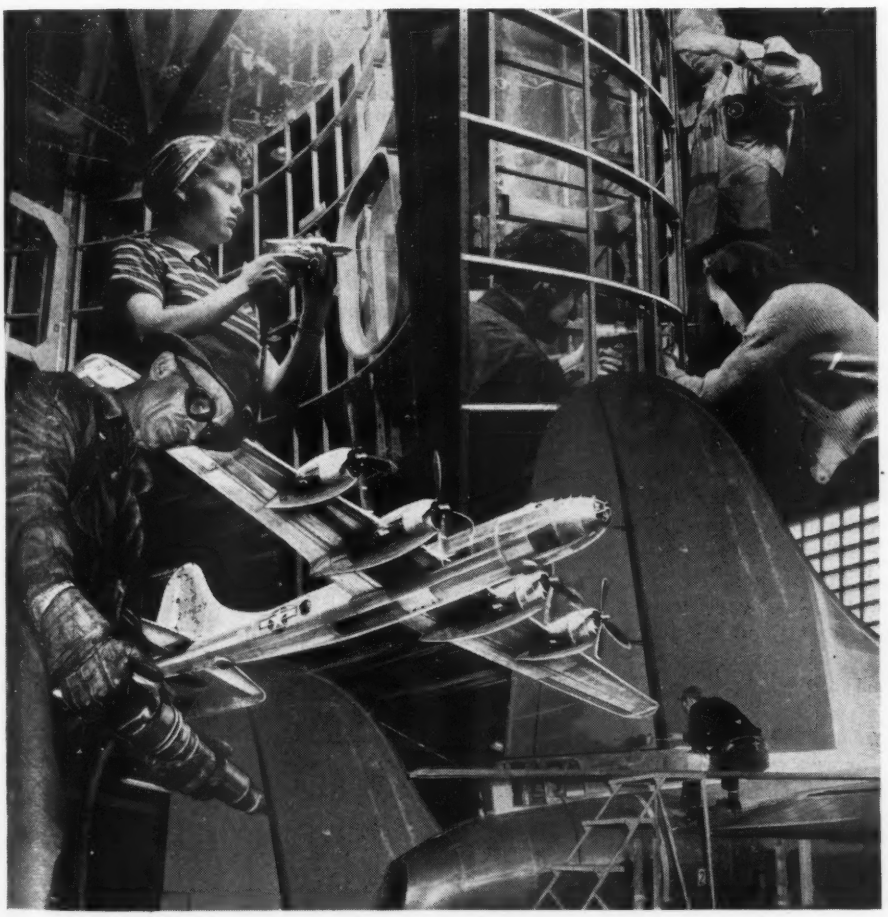
William H. Wright, an exceptional prospector, died last month in Barrie, Canada. He was exceptional because he held on to most of the claims he staked and died a wealthy man. He was the Wright in Wright-Hargreaves, a gold mine that has paid more than $45,000,000 in dividends. Its discovery, which he made in 1911 with Ed Hargreaves, was the first in the Kirkland Lake District.

Chance played a big part in Bill Wright's success. Born in England, he served in the Boer War and was awarded a veteran's grant of land in the Porcupine District of Canada. That acquistion largely impelled him to migrate to Canada, which he reached in 1907. Prospecting on his holding gave him the rudiments of the mineral-searching technique, but he found nothing of value. He soon went to Cobalt, then a budding silver camp, where he prospected at times and lived by following his trade of butcher and doing odd jobs such as painting houses.

In the summer of 1911 he and Hargreaves made a prospecting trip to Kirkland Lake. On their second day there, Hargreaves started out to hunt game for food, and it was agreed that if he became lost he would fire his gun and Wright would respond in like manner so that Hargreaves would know which way to go to reach camp. As dusk was setting in, Wright heard a shot, fired his own rifle as agreed, and then set out through the brush to meet his partner. He hadn't gone far when he saw an outcrop of quartz. It was too dark to examine it carefully, so he placed a discovery post there and returned to camp. Next day the two men staked two more claims, that being all they had funds to record at $10 each. Those claims, together with another one staked a few days later, became part of the Wright-Hargreaves Mine.

Then they made arrangements with some Cobalt men to stake claims for them in return for part interests. Some of these became a part of Sylvanite Mines, another successful producer. Hargreaves soon sold his share in the claims to get money for building a home in Haileybury. Wright kept most of his holdings, disposing of only enough to enable him to do more staking. One of the latter acquisitions was turned over to Harry Oakes for a substantial stock interest in Lake Shore Mines Limited. The ground never produced a pound of gold, but the stock helped make Wright rich. When the first World War broke out he enlisted, and is reported to have been the only millionaire private in the Canadian forces.

Until his death, Wright served as a vice-president of both the Wright-Hargreaves and Lake Shore companies. When the price of gold was raised in the early 1930's, he sold a considerable portion of his stock and bought two Toronto newspapers, but subsequently disposed of a large share of his interest in them. Having been assigned to the cavalry when in military service, he acquired a fondness for horses and soon after his discharge began breeding racing stock.



PRODUCTION FOR DEFENSE

This illustration appeared on the front cover of a recent issue of "Defense Production Record," a weekly newspaper published in Washington on behalf of the Defense Production Administration. It was captioned "Manpower for Airpower." It will be noted that the individual pictures, combined here in what artists call a montage, all concern airplanes and their manufacture. This field was selected with good reason as typifying the defense effort. Employment in the aircraft industry, reports the Bureau of Labor, totaled 413,200 in April, a gain of 160,000 in a year. Although many types of tools and machines come into play in fabricating airplanes, pneumatic and electric portable tools unquestionably lead the list. Recognition of their importance is found in the prominence given them in this government-directed pictorial display.

★ ★ ★

Finis for Portland Quarries

An article in our August issue called attention to the decline in the use of brownstone, once considered ultrafashionable. We showed pictures of the greatest of all the brownstone quarries located at Portland, Conn., across the river from Middletown, commenting that they were virtually inactive but ready to fill any order that might come in. Apparently, our account was timed closer than we realized to the termination of operations in these cavernous pits, now filled with water, which have yielded stone ever since 1652.

Believing that the operators of the quarries would be interested, we mailed five copies of our August issue to the company office. Some 60 days later, early in October, they were returned, with a notation by the Portland post office that they had been refused. Not understanding this, we wrote the company to inform it of what had happened and indicated our willingness to remail the copies. On October 16 there came a reply from William A. Dickinson, 3rd., assistant Trust officer of The Middle-

town National Bank which, incidentally, is in its 150th year and the fifth oldest national bank in the country.

"This bank," wrote Mr. Dickinson, "has been appointed liquidating agent for the Portland Brownstone Quarries, whose business affairs are now in the process of being terminated." We thus note the passing of what our research indicated were the first quarries for building stone opened in the American colonies.

★ ★ ★

Covered Bridge Revival

So far as Massachusetts is concerned the covered bridge has not outlived its usefulness. Instead of replacing its 12 remaining ones with modern steel-and-concrete structures, the state will duplicate the existing wooden spans. This decision is not based on sentiment alone, although it is true that some portions of the populace have strongly urged that covered bridges not be allowed to disappear. Actually, a covered timber structure costs about 20 percent less than one of steel and concrete and lasts longer. All this despite the fact that the covered bridge is supposed to violate some laws of engineering. California has also built some covered bridges in recent years, especially in remote sections, where engineering studies have determined they are the most practical choice.

★ ★ ★

Babassu Nut Cracker Wanted

Although the human brain has contrived to split the atom, it hasn't yet figured out a good way to crack the nut of the babassu palm tree. Until it does, a mammoth potential industry in South America will not come into its own. In Brazil, an estimated 5 to 25 billion babassu palms are spread over 33 million acres. A mature tree often yields a ton of nuts, containing 200 pounds of kernels. The kernels run from 65 to 68 percent in oil that is desirable for many purposes, including cooking and soap-making.

The nuts fall to the ground when they ripen. The trick is to crack them without bruising the kernels since this causes them to become rancid within 48 hours. Natives, many of them women, seated on the ground, now crack them as follows: A machete or hatchet is held blade upward firmly between the knees or feet, a nut is held on the blade and pounded with a heavy stick until it cracks and releases its 4 or 5 kernels. In the State of Maranhao alone 75,000 persons are thus occupied. Given a satisfactory mechanical cracker, the babassu industry could cut costs and boom.

"SCRAPPY" MEETS MOBILIZATION CHIEFS

Enlisted in the campaign to get out scrap for the steel industry, The Advertising Council, Inc., prepared a plaster-and-cloth figure to represent the object of their publicity drive. It is shown here with, left to right: Robert D. Mossman, manager of advertising, Jones & Laughlin Steel Corporation and volunteer co-ordinator of the Council's campaign; Charles E. Wilson, Director of the Office of Defense Mobilization; Manly Fleishmann, administrator, National Production Authority; T. S. Repplier, president, The Advertising Council. Approximately 36 million tons of scrap is needed to keep the steel industry going at full speed this year. The placard reads: "Scrappy says, Aid Defense, More Scrap Today, More Steel Tomorrow."

Tube System Saves

A large West Coast manufacturing plant maintains a pneumatic-tube system solely for handling blueprints. More than 7000 feet of tubing connects the central blueprint room with outlying technical departments. A telephone call brings a print at a speed of 20 to 25 feet per second to the nearest substation, where it is picked up by messenger. After it has served its purpose it is returned in like manner. According to *Production Engineering & Management*, only two prints are now prepared of each drawing—one of which is on call and the other in reserve. Before the system was put in, as many as fifteen were required to meet the demand. The cost of making blueprints has been reduced 40 percent. The same concern operates 15,000 feet of tubing between departments for transporting messages, routing forms, small parts, etc.

★ ★ ★

Novel Power Plant

A hydroelectric plant now being built at Montzepat, near the head of the Loire River in France, will be located underground for security reasons. From a storage reservoir, water will be conveyed 10.6 miles through a tunnel and then plunge 700 feet through penstocks to the turbines. Two thousand workmen are engaged on the $27,000,000 undertaking, which is scheduled for completion in 1953. The power to be made available is expected to reduce France's annual coal and oil imports by 250,000 tons and 165,000 tons, respectively.

★ ★ ★

Future Flour Mills

Authorities predict that flour mills of the future will rely solely on compressed air to move grain through the treatment process, replacing traditional bucket elevators and screw conveyors. Pneumatic conveying is faster and both cleaner and less wasteful, because no material need spill on floors. According to *Business Week*, only one strictly modern flour mill has been built in the United States in the past 25 years. It is a General Mills plant in Los Angeles, Calif., which uses "airveying" extensively and also instruments to control many operations. It is claimed that our mills must modernize to stay in business. European mills have done this, and now we export virtually no flour to those places. As a consequence, American production has dropped 25 percent and profits have dwindled. Because of the reluctance of our millers to adopt new machines and methods, development of machinery in this country has lagged. European designers, on the other hand, have registered continual progress. Our millers are loathe to buy the foreign machines because they must pay a stiff import tax.

Power from Waste Coal-Mine Gases

GASES now wasted in coal mining may eventually be used to produce power through the medium of turbines similar to those on jet aircraft, according to Sir Alfred C. G. Egerton, a distinguished British chemist and professor of chemical technology at the Imperial College of Science and Technology of the University of London.

When coal is mined, some of its energy escapes as methane gas. Though negligible in quantity—only about 1 percent of the total—it might, if it could be made available, supply collieries with a large amount of their power needs. There are instances where some of this gas is burned under boilers to generate steam, but the quantity salvaged in this way is only a fraction of the energy that is now wasted. The gas turbine may prove an effective means of turning this loss into gain. It operates much like a steam turbine; but where the latter drives a rotor with a blast of high-temperature steam, the former directs hot gases against the blades.

By the proposed method, some of the ventilating air blown into a mine would be preheated to a temperature at which the methane, when mixed with the air, would burn. The hot gases would drive the turbine, and the hot exhaust would serve to preheat more air needed for the process of combustion. It has been determined by laboratory experiments that if air and methane, at a concentration of 5 percent, are heated separately to approximately 1800°F, combustion takes place about five-thousandths of a second after they are mixed, which is rapid enough for the purpose. Man uses annually around 2200 million tons of fuel—1400 million tons of coal and the equivalent of another 800 million in oil and natural gas. Of this total, 1800 million are not usefully applied!

PHILADELPHIA LABORATORY

Spray booth showing a Mogul type Powerflow pump applying a heavy coating to a removable panel to determine its pumping characteristics.

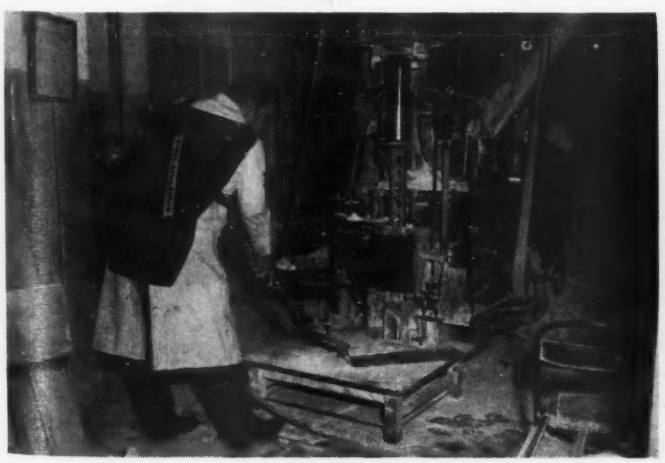
Testing Spray Materials

LABORATORIES designed especially for testing coatings, adhesives, sealers, greases and the like have been established by Gray Company, Inc., for the purpose of providing the data necessary to apply them with maximum economy, speed and efficiency. One is in Minneapolis, Minn., a new one has recently opened its doors in Philadelphia, Pa., and a third is planned for Atlanta, Ga.

Manufacturers and users of these industrial fluids and semifluids, which differ so widely in composition and consistency, as well as refiners of petroleum products may submit samples to the laboratory in their territory, accompanied by a description of each, the service it performs, etc. There, trained technicians determine their pumping and spraying characteristics, air pressures required, air consumption, type of nozzle or spray head, and all the other factors that should be known in order to choose the equipment best adapted to handle and apply them.

Adaptable Industrial Cleaner

USING compressed air at 80 psi, Patterson Products' new industrial cleaner is an innovation in equipment of this kind. The air is supplied from a shop line or other source by a flexible hose attached to the handle of the unit and is controlled either by a grip or button spaced so that the operator can manipulate them with one hand. If vacuum is to be applied, the air flows to the suction head of the cleaner and then back through a restricted orifice into a Venturi tube. Laden with dirt, it is exhausted either into a bag carried on the worker's back or into a tank. Pressure on the button shifts the flow instantaneously to a passageway leading to an air jet, which is an exterior but integral part of the head. In each case, the air is caused to pulsate at the rate of 2000 times a minute, it is claimed, by a vibrating valve which gives the cleaner its extra-strong suction and blasting power. Interchangeable orifices, ranging in diameter from $\frac{1}{8}$ to $\frac{5}{64}$ inch, are provided so that different degrees of vacuum can be induced for light, average or heavy jobs. Air consumption is low by reason of the action of the unique air valve and varies from 2.7 to 7.7 cfm. The new cleaner is safe to use in dusty places or where there is danger of fire from sparks.

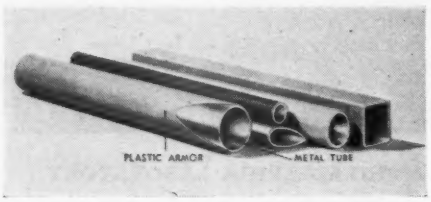


COMBINATION VACUUM CLEANER AND AIR JET

By changing the container, size of nozzle or squeegee, handle and Venturi orifice, and by manipulating either one of two controls, the unit can be adapted for all kinds of jobs from cleaning floors (left) and upholstery to removing metal chips from machinery (right). For wet operations a tank is substituted for the bag, which is supported on the back by a belt-and-harness assembly. The tank is designed to clean and wash the suction air. This is done by passing it through a pipe into water and then filtering it through a coarse and a fine screen.

Industrial Notes

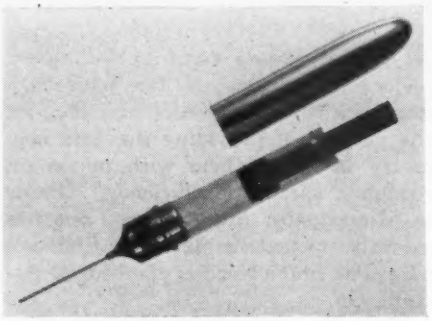
To its line of round Dekoron tubing, Samuel Moore & Company has added square, triangular, oval and streamlined shapes of a large variety of sizes, colors and finishes. It consists of seamless



metal tubing, or tubing with welded, lap or butt seams armored by a patented extrusion process with vinyl or polyethylene plastic that, it is claimed, will not crack, chip, peel or flake; resists the corrosive action of salt air, moisture, oils, acids and alkalies; and is not affected by temperature changes. Can be used as instrument lines and electrical conduits, but has many other industrial and consumer applications.

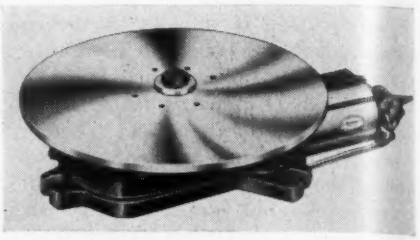
Switzerland is importing something new in mechanical pencils for draftsmen. The lead is flat instead of round and as thin or thick as the line to be drawn. Only occasional adjustment is required, it is claimed, because the lead feeds semiautomatically while the pencil is in use. A sliding metal guide prevents breakage of the lead, which does not have to be sharpened. Named Mira, the pencil is available in two styles: 45 Heavy Line and 30 Light Line, 0.018- and 0.012-inch thick, respectively. The lead comes in four grades.

As a companion piece to its Hypo-Oiler, put on the market less than a year ago, Gaunt Industries has designed a grease applicator on similar lines. Called Hypo-Lub, it is of convenient pen size so it can be carried in the pocket always ready for service. It has a fine hypodermic needle protected by a dustproof cap, and pressure on a plunger releases the grease, which is



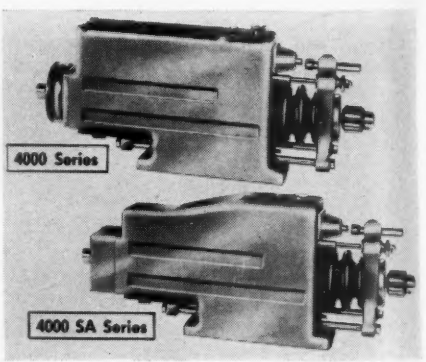
stored in a transparent-plastic chamber. The new lubricator is suitable for home, office and factory use.

For heavy-duty service, The Bellows Company is making a rotary work feeder that can be set to index at 4, 6, 9, 12, 18 or 36 stations. The table has a diameter of 22 inches and is powered by a special 3⅝-inch-bore air cylinder



with a built-in Electroaire directional valve and speed regulator. The valve is actuated by 12-volt solenoid controls which are guaranteed against burnout. Cushioned air gently eases the table into position, where it is locked by the pneumatic cylinder. Designated as Model Bret-22, the feeder is said to index loads up to 1000 pounds quickly and accurately. Top is easily removed for mounting jigs and fixtures as well as oversize tables.

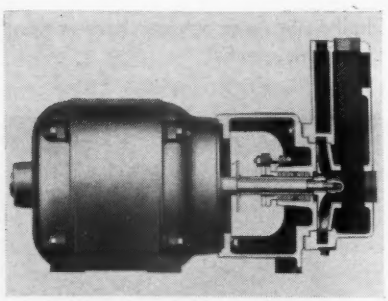
For the small-hole drilling field, Locke Gage Company has developed two units: a light-duty model (4000 S-A Series), which draws upon a shop air line for power that is exerted against a piston with a surface 3 inches square, and a heavy-duty unit (4000 Series) with a self-contained power source including a 2-cycle refrigerator-type compressor. The latter model permits pressure adjustments from 0 to 500 psi and drills holes with a maximum diameter of 5/16 inch in alloy steel and the like. The other one drills diameters up to ¼ inch in mild steel or its equivalent. Both operate automatically without the use of gears, brake or clutch, have built-in



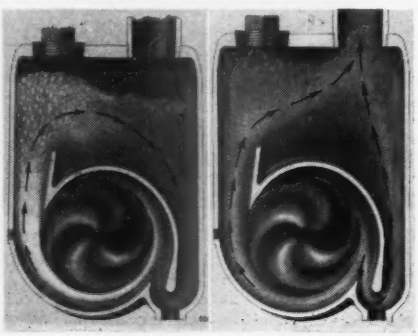
electric solenoids and hydraulic check mechanisms that permit units to be mounted at any angle and still assure flow of oil from reservoir to restricting chamber. Positive hydraulic control over thrust makes possible half-hole drilling and starting drills on angular faces. Spindle travel is 3 inches, of which any fraction may be used. Units can be adapted for tapping and burnishing by

---

Ingersoll-Rand Company has introduced a new line of self-priming Motorpumps for applications under suction lift where the presence of air or vapor makes it impracticable to use conventional centrifugal pumps. The new type is of dual-volute construction and recirculates fluid in the casing. This is done without valves or other complicated moving parts. The impeller discharges the flow through the two passages into a discharge chamber. During priming the upper volute delivers a mixture of liquid and vapor into the chamber, where the vapor separates from the liquid and passes out of the outlet pipe. The remaining liquid reënters the impeller through the lower passage to mix with more vapor drawn in from the suction pipe. When the latter is finally filled with liquid and the pump is primed, the flow through the lower volute reverses itself and both passages serve as normal pump discharges. The new Motorpumps are recommended for process and bulk station applications, for mine and sump drainage, for bilge pumping and handling irrigating water. They are built in sizes from ½ to 25 hp, have a capacity range up to 800 gpm, and operate under a maximum head of 180 feet. Standard models have cast-iron casings and bronze impellers and are driven by NEMA motors. They are also available mounted on ball bearing cradles for motor, engine, or turbine drive through couplings. Some parts are interchangeable.



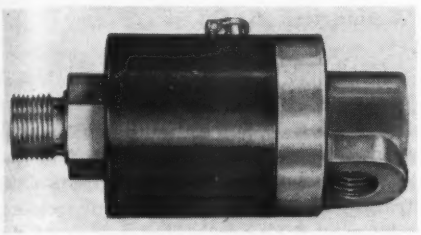
SECTIONAL VIEW OF PUMP



LIQUID FLOW DIAGRAM

making simple changes, and a deep-hole attachment can be used to drill an additional 3 inches.

To its line of water, steam and vacuum unions, Deublin Company has added an air union for the transmission of air from stationary to rotating machine parts. It has an aluminum housing and end bell for lightness and two sealed-



for-life, single-row ball bearings for rigidity and precision performance at high speeds. The latter also account for the low temperature rise under continual use. The Model 1105 features a new method of balanced sealing that is said to prevent line pressure from increasing the load on the sealing faces, to minimize wear, and that permits of a constant minimum starting and operating torque. Hardened and lapped Graph-Mo faces of tool steel running against lapped carbon sealing faces form a leak-proof seal. If worn, the sealing faces can be replaced, often without removing the union from the equipment. Two types are available: the standard union for shaft mounting and the special union for in-the-shaft mounting to reduce overhang. Maximum operating speed and air pressure are 3500 rpm and 150 psi, respectively.

Recent tests made of three Unitite valves, incorporating the latest design and construction features, indicate that these Hanna Engineering Works hand-operated units will give maintenance-free operation for from 10 to 15 million or more cycles. This remarkably long life is attributable, according to the company, to a chrome-plated stem for minimum wear, a Neoprene-stem collar to prevent abrasion from ambient dust, a standard grease fitting at the top of the stem, and a lumen-bronze disk. Unitite valves are small to permit installation in close quarters and are made for 3- or 4-way operation by air, oil, or water.

Something new in portable signal flashers for general service has been announced by Haledy Electronics Company. Of cold cathode-tube design, it is said to emit, with unfailing dependability, a sharp and brilliant flash of light that is clearly visible for a distance of approximately one mile. It has a set of three standard 90-volt batteries used in series, and all the current generated produces light—none is wasted

in making filaments glow, operating relays, heating thermal elements, or running motors. For that reason the life of the batteries is appreciably lengthened. Housed in an aluminum case, the flasher is unaffected by temperature, humidity and vibration and weighs only 8½ pounds. It is provided with an on/off switch and a knob that controls the number of flashes per minute.

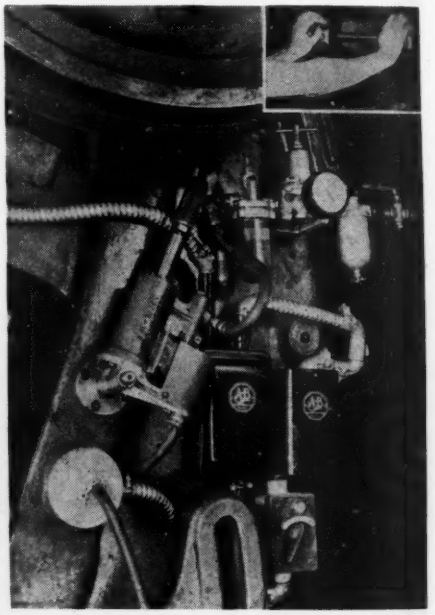
According to a research report prepared by the Dow Chemical Company for the U. S. Air Force, magnesium alloys made by a new compression process are generally superior to those produced by the conventional method. In the case of the latter the magnesium and alloying metals are fused, cast into ingots or billets and extruded. By the improved method fewer steps are involved because the magnesium and alloying metals are in powder form and require only mixing and extrusion. In summarizing, the report states that many of the resultant alloys are stronger than those of the same composition made by melting and casting and that it is possible with the powder-compression technique to produce compositions heretofore not obtainable and possessing

---

"If they're burying a bone, it must be a big one."

exceptional strength, high corrosion resistance, and better than normal fabrication characteristics. The 445-page report, entitled *The Properties of Magnesium Alloys Fabricated from Atomized Powder*, is obtainable in photostat or microfilm form for $56.25 and $9, respectively, (check or money order payable Librarian of Congress) from the Library of Congress Photoduplication Service, Publication Board Project, Washington 25, D.C.

Designed primarily for direct clutch presses with not more than 60 pounds pull and a 2-inch up-and-down movement on the clutch tripping rod, the guard shown in the accompanying illustration can be adapted for spot welders, brakes and shears. The unit is of the electropneumatic type and is actuated by a set of electric buttons located far enough apart on the press so that the operator must use both hands to energize the solenoid valve by which to complete

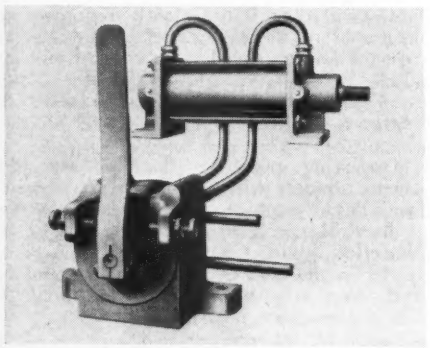


the circuit that causes the ram to make one cycle. Thus they are kept out of harm's way ready to pick up the next work piece. An antirepeat switch and cam allow the ram to descend only once; both buttons must be pushed each time to reënergize the valve. However, for blanking long stock, a foot attachment may be plugged in to make the press automatic in its action. With interlocking dies, a limit switch may be installed to prevent the press from functioning until the die and work are in proper position, thus protecting both machine and die from damage. The punch-press guard—Model AE 60—is built by Tech-n-Kal Machine & Engineering.

Turbojet engines are being packed for shipment in what manufacturers call a bathtub—a 2-section container made of heavy-gauge steel plate. Positioned on rubber-mounted hangers, the engine

floats in the case. After the top half has been bolted in place against a rubber gasket, which forms a seal, air at a pressure of about 5 psi is admitted through a valve. "Canned" in this way for protection against damage and moisture, the engines could be salvaged if lost at sea because the bathtubs would keep them afloat.

Speed and direction of travel of double-acting air cylinders are controlled by a 4-way valve of simplified design offered by Wisler Engineering & Machine Company. As the accompanying picture shows, the valve, known as the Sincron, is sufficient in itself to perform these operations which, conventionally, call for the services of one direction- and two speed-control valves. Moving the lever right or left changes the direction of flow, which is indicated by the position of the lever, and a special oscillating disk regulates the speed of the piston stroke from zero to full valve capacity in either direction. Three models are available, each in four sizes, and



may be used as 3-way valves by plugging one of the cylinder ports. Standard units are built to operate at pressures ranging from 0 to 250 psi, and all types may be utilized for either air or hydraulic service because the valve stems are sealed with airplane-type O rings.

What is said to be the highest lift by a single traveling conveyor is accomplished at the Orient Mine No. 3 of the Chicago, Wilmington & Franklin Coal Company in southern Illinois. There a 42-inch-wide Goodyear belt is installed in an inclined shaft on a 16-degree slope and can raise 1200 tons of coal per hour a vertical distance of 868 feet. The distance between the tail pulley underground and the head pulley on the tipple is 3290 feet. The latter pulley is driven by a 1500-hp synchronous motor that moves the conveyor at a speed of 625 feet per minute (about 7 miles per hour). The belt has a 40-ton steel cable core, while the fabric weighs nearly 12 tons and the rubber 37½ tons. When fully loaded, it will carry 105 tons of coal at a given moment, making a total weight of 194½ tons for coal and conveyor.

Books and Industrial Literature

In a 96-page pocket-size catalogue Abart Gear & Machine Company gives complete engineering data on how to select the proper speed reducer for any one of a variety of requirements. Entitled *Abart Speed Reducers and Gearmotors*, it may be obtained by writing the company at 4834 West 16th Street, Chicago 50, Ill.

Capewell Manufacturing Company, 60 Governor Street, Hartford, Conn., has published a new catalogue and pricelist on its complete line of hand and power hacksaw blades, metal and wood cutting band saws, band knives, pipe and bolt threading machines, etc. Copies are available upon request.

Plants with the age-old problem of unsatisfactory check-out facilities for tools, jigs and dies might do well to look into the Kolect-A-Matic and Kardex systems recommended by Remington Rand Inc., 315 Fourth Avenue, New York 10, N. Y. Pamphlet KD 641 from the Management Controls Division will be sent upon request.

A new bulletin describing the unusual features of Fischer & Porter Company's Automatic Flow Ratio Control Systems is now available. It deals with the operating principle of as well as the fundamental reasons for improved ratio control and includes a list of typical applications. Write for Catalogue 53 to 4600 County Line Road, Hatboro, Pa.

Operating portable, flexible-shaft and bench grinders without proper guards is a hazardous practice that violates safety codes. Morrison Products, Inc., of 16816 Waterloo Road, Cleveland 10, Ohio, is a leader in the field of grinding-wheel guards and offers a 4-page bulletin describing its full line of these protective devices.

A pictorial trip through a leading rubber-parts and equipment plant can be yours by writing Automotive Rubber Company, Inc., 8601 Epworth Boulevard, Detroit 4, Mich., for its free catalogue. Arco says that anything can be covered with rubber, and its 11-page publication shows a large variety of parts and equipment in process of being coated.

If you have problems in connection with the moving of heavy equipment or rail cars on sidings, at loading docks, on piers, in mines or elsewhere you may be interested in electric car pullers built by American Hoist & Derrick Company, St. Paul 1, Minn. The complete line is described in Catalogue No. 100-H-66, which the company will mail upon written request.

A new folder has recently been published by Naylor Pipe Company, 1230 East 92nd Street, Chicago 19, Ill., on its one-piece Low-Pressure Wedge-Lock Coupling designed for connecting lightweight pipe for ventilating and similar services. Complete specifications are given on pipe sizes ranging from 8 to 30 inches in diameter. Copies of the bulletin may be obtained by writing direct to the company.

Protective hats save lives and prevent countless head injuries each year. Still, some men won't wear them in hazardous places unless forced to do so. As an educational feature, Mine Safety Appliances Company is sending out every Skullgard made by it with an illustrated booklet giving case histories that prove the value

of the hard-boiled hat. Copies for distribution may be obtained by writing the company at Braddock, Thomas and Meade Streets, Pittsburgh 8, Pa.

Logansport Machine Company, Inc., Logansport, Ind., has reprinted by demand its pocket-size booklet on *The Facts of Life on Air and Hydraulic Devices.* It enters into the do's and don'ts of and what to look for in setting up and servicing air and hydraulic equipment, information that has made it a popular guide for design and servicemen. Copies are available for the asking.

Industrial plants requiring fast and highly accurate control instruments for regulating pressure, temperature, flow and level may like to know all about The Swartwout Company's first miniature all-electronic system. Known as the Autronic System, it is described in a 4-page illustrated bulletin—A 701—that can be obtained from the company at 18511 Euclid Avenue, Cleveland 12, Ohio.

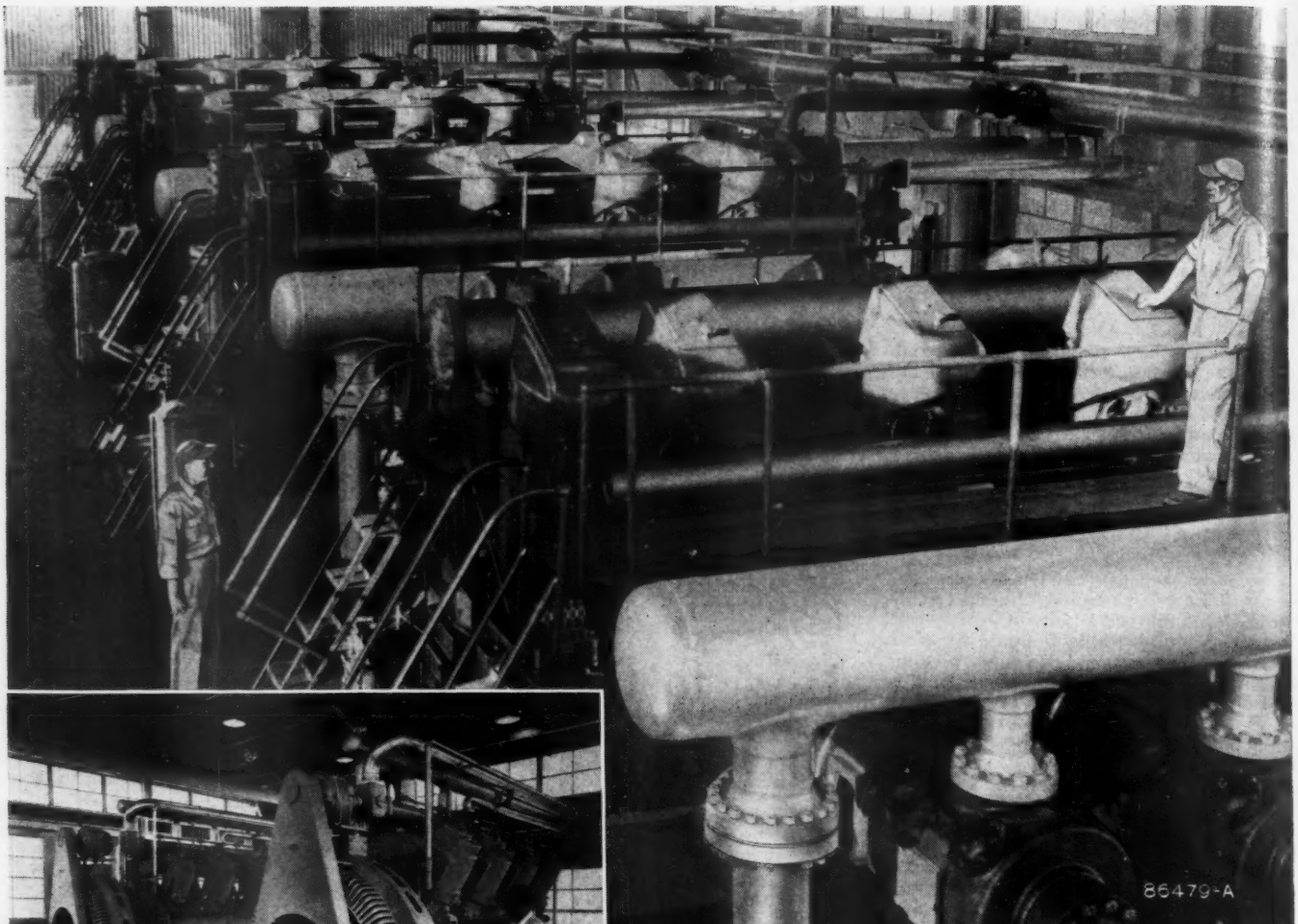
For users of gauges, the Chemiquip Company, 6 East 97th Street, New York 29, N. Y., has published a bulletin dealing with its new Micro Metallic Pressure Snubber. It is said to give steady average pressure readings, to smooth out pressure impulses and fluctuations, to eliminate gauge failure due to shock, and to remove harmful solids from actuating fluids. Copies are available upon request.

Norton Company, Worcester 6, Mass., has released a comprehensive 55-page booklet on the finishing of small metal parts. It is entitled *Barrel-Finishing with Alundum Tumbling Abrasive* and is divided into three sections dealing, respectively, with features of alundum tumbling abrasive, barrel-finishing procedure, and practical hints to operators. Copies are obtainable without cost.

Phillips Manufacturing Company, 3475 Touhy Avenue, Chicago 45, Ill., specialist in degreasing equipment, has available for free distribution an illustrated bulletin covering its complete line of vapor degreasers for the removal of oil, wax or grease from small and bulky metal parts. It explains the process, gives capacities and uses of each unit, and shows industrial applications for both tank- and conveyor-type degreasers.

Bulletin GEA-5600, recently prepared by General Electric Company, shows how electric power for quick industrial expansion can be obtained on time, at low cost and with a minimum of critical materials. The answer is packaged power, units made up of standardized components that are ready for operation when delivered and that eliminate the need of individually engineered assemblies. The 23-page publication contains numerous illustrations and diagrams and will be mailed to anyone sending their request to the company at Schenectady 5, N. Y.

Resistance welding of nickel and high-nickel alloys is the subject of Technical Bulletin T-33 published by The International Nickel Company, Inc., 67 Wall Street, New York 5, N. Y. Besides covering spot, seam, projection and flash welding and resistance brazing, the 30-page booklet presents tables on mechanical properties, chemical compositions, recommended conditions for welding and other essential information. It can be obtained without charge from the Technical Service Section of the company's Development and Research Division at the address given.



Four Ingersoll-Rand 1320-hp Type KVG Compressors at Slaughters, Kentucky, station.

Two 406-hp Type PVG Gas Engine Generator units at Jeffersontown, Kentucky, station.

I-R COMPRESSORS and ENGINES on Texas Gas Transmission Corp. Line

A number of stations on the 800-mile Texas-to-Ohio line are served by INGERSOLL-RAND Type KVG Gas Engine Compressors, and Type PVG Gas Engine Generator Sets. This line with a capacity of approximately 400 million cubic feet per day serves customers in seven states.

You will find these INGERSOLL-RAND heavy-duty engines and compressors serving all types of petroleum projects, pipe lines, refineries, gasoline plants, repressuring, gathering, etc. For full information contact the nearest Ingersoll-Rand Branch office.

4-CYCLE

Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y. 631-6

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • DIESEL AND GAS ENGINES